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Aircraft Survivability Equipment Trainers

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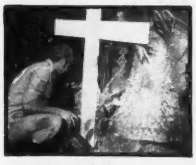

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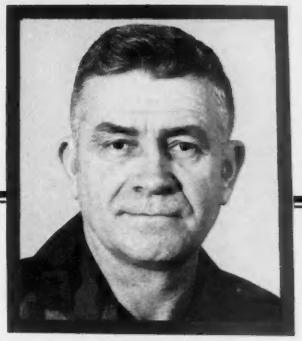
Major General Ellis D. Parker
Chief, Army Aviation Branch



DOCTRINE — The Driving Element of the Total System

THE U.S. ARMY Training and Doctrine Command (TRADOC) recently made a change that will have a far-ranging and significantly favorable impact on the quality of our doctrinal literature, and consequently the professionalism of our soldiers. TRADOC placed the principal responsibility for writing doctrinal and training publications squarely on the shoulders of the platform instructors.

Why?

Because these instructors *are* subject matter *experts* in their respective fields. They "grew up" in their specialty fields, acquiring the unique knowledges, skills and experiences that, when taught from the platform, come to "life" in the minds of our students at the Aviation Center.

By writing the doctrinal and training publications, the instructors greatly increase their teaching range, making our doctrinal and training publications "come alive" in the minds of soldiers Armywide.

As writers of doctrinal and training literature, the instructors first of all are sensitive to your thoughts and requirements. Their first step is to prepare a preliminary outline showing the proposed contents, the extent of subject coverage and the sequence of presentation. This outline is then staffed at Ft. Rucker and with other agencies as required. Meanwhile, the instructors visit you in the field to gather information and lessons learned from your perspectives.

After the outline is staffed at the Aviation Center only and approved by the assistant commandant/commander, then the preliminary draft is prepared. Like the outline, it is only staffed at the Aviation Center. It is evaluated and comments resulting from the reviews are incorporated into the field circular/coordinating draft.

From preliminary drafts, field circulars are developed to serve as coordinating drafts for subsequent Department of the Army (DA) use to print field manuals. The field circulars are intended to solicit your comments, recommendations and other input from users and interested agencies outside Ft. Rucker. It is also a way to rapidly disseminate current, emerging doctrine on a one-time basis, pending publication of the DA-approved manual. The doctrinal field circulars are sent to major Army commands, TRADOC service schools, integrating centers, corps, Active and Reserve Component divisions, National Guard maneuver area commands, the National Training Center, the Military Academy, the 7th Army Training Command and also to selected brigades, groups and battalions.

As stated earlier, our instructors are the principal writers of our doctrinal publications. However, the experts in doctrine and tactics are not all located here at the Aviation Center. They are spread throughout our entire Army Aviation force. For this reason, I urge Army Aviation leaders at all levels to thoroughly review the interim publications and furnish us your comments and recommendations regarding their adequacy and accuracy. This is your opportunity to influence Army Aviation doctrine, the driving element of the total system. Together we can build the excellent doctrine needed by the Army of Excellence to meet and defeat the challenge facing us on the modern battlefield.

CW4 Perry M. Smith
Directorate of Training and Doctrine
U.S. Army Aviation Center
Fort Rucker, AL

MONTHLY WRITING AWARD

AIRCRAFT SURVIVABILITY EQUIPMENT TRAINERS

SINCE THE BEGINNING of time, there have been wars and rumors of wars. Mankind is constantly seeking a weapon to defeat his enemy. As each new weapon enters the conflict, the key to survival has been the quick development of an effective countermeasure.

In early combat, the weapons were basic and physical in nature, requiring only simple armor protection or a shield as an effective countermeasure. Centuries have passed and with the evolution of man, warfare and weapons have followed a parallel path to complexity. On today's battlefield, terrain flight techniques and aircraft survivability equipment (ASE) have emerged as Army Aviation's modern countermeasures.

Flying the aircraft in a safe profile, such as nap-of-the-earth, avoiding optical or radar detection, is the best defense. The mission and terrain will not, however, always allow total safety. This is where ASE plays a vital role. ASE is the equipment developed for the express purpose of:

- Reducing the aircraft signature or detectability.
- Providing an alert to the aircrew of a Threat presence.
- Providing a means for the pilot to weaken the Threat function of acquisition or firing.
- Providing a signal that decoys a Threat-launched weapon.
- Providing airframe design that can accept a degree of Threat damage without mission degradation.

In a hostile environment, ASE has the same lifesaving potential and mission fulfillment capability as the engine, transmission and flight instruments. Just as you would not wait until you had a transmission failure to learn what a chip caution light is, you should not go into combat without understanding ASE. The aviator must obtain the same proficiency with ASE as with his other aircraft instruments.

For this reason, the U.S. Army Aviation Center and the Project Manager for Aircraft Survivability Equipment (PM-ASE) have begun a campaign to provide this training — not only institutional training at the Aviation Center, but also sustainment training in the field. This is being accomplished through the development and update of manuals and lesson plans, the incorporation of ASE into the flight simulators and into the Aviation Combined Arms Team Trainer. The most intense efforts are being directed toward developing and fielding of the Aircraft Survivability Equipment Trainers (ASET). The ASET family includes desktop (ASET I and II), inflight radar warning (ASET III), and electronic warfare (EW) range/threat emitters system (ASET IV).

ASET I

Ready For Training, July 1985

In reaction to the urgent Armywide need for ASE and Threat training, PM-ASE searched for a means to solve the problem as quickly as possible. The fastest is not always the best; yet, time to field the optimum trainer was not available. For this reason, the ASET I program was initiated as an interim trainer and a hot test bed for the long-term optimum trainer, ASET II.

ASET I is a software package that is used with the AN/UYK-71 Microfix Computer System as a desktop mode ASE trainer. The Microfix, used by the Military Intelligence (MI) community, has TEMPEST certification that permits the processing of classified training information. Use of classified material is necessary to properly train ASE and Threat. The Army Aviation community will use the Microfix on a timesharing basis with the MI community.

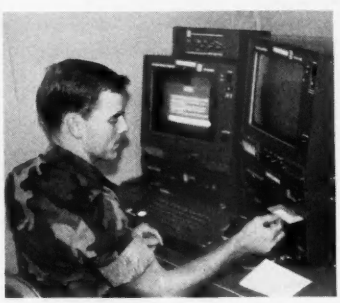
In addition, funding has been approved for the purchase of a Microfix system to be collocated at each synthetic flight training facility for the sole purpose of aviation training.

The ASET I employs the two Microfix monitors to provide instruction to the student aviator. Written training information is presented on the monochrome screen in plain language. When appropriate, the second monitor supplements the written text with full color still photos and motion/audio sequences.

The primary subject areas covered by ASET I are Threat, ASE and the tactics of how they interact with each other. The first disc provides an overview of the entire program. The overview provides an introduction to ASET I and serves as a quick refresher. This disc presents a summary of the subjects in ASET I, but it is not in the detail necessary for the aviator to become proficient in ASE. Furthermore, the overview disc lacks the test section on subjects covered.

The remainder of the disc will provide detailed lessons on ASE, Threat and related subjects. Once the student has completed the lesson or, depending on his proficiency in the subject, he may elect to go directly to the desired test section. The aviator will receive immediate feedback on answers. Training aviators then have the option of returning to the text for review or continuing to the next subject. The questions and answers are randomly scrambled each time the test is displayed.

The ASET I package is designed for each aviator to have an individual training records disc. The disc contains I.D. information about the student, training dates, and tracks the



The AN/UYK-7 Microfix computer (left and below) used in support of ASET I program.

student's progress through the training lessons and records results of tests taken. This allows the student and the unit standards section to keep track of subjects studied and locate where areas of weakness, if any, exist.

The threats to Army Aviation on a modern-day battlefield are broken down into the following groups: radar, infrared and optic. These groups are further broken down to specific weapon systems. A complete description of the weapon is given to include the capabilities, limitations, modes of operation, related equipment, weapons employed with it and where it is employed on the battlefield. Many of the written instructional frames are supplemented with visual and audio presentations on the color monitor.

ASE lessons, to include identification of friend or foe, are divided into groups according to the type weapons they may counter. A complete description on the operation of the equipment and the procedures an aviator needs to know to test a system are provided. The capabilities and limitations of each system are provided in relation to the specific weapon it was designed to counter. This is the basic information needed for ASE to be of any value on the battlefield.

Once the aviator has completed the lessons, he is ready to progress into the scenarios. This is where he must merge the knowledge of the ASE, Threat, mission and aircraft to survive a simulated hostile environment. Due to time constraints, the ASET I has been directed primarily toward the mission and equipment profile of the AH-1S Cobra and the OH-58 Kiowa aircraft. However, a very large percentage of the data is generic to all aircraft. For this reason, it will be available to all aviators.

NOTE: This program needs maximum exposure since it will provide test bed data for ASET II.

ASET II

Ready for Training, Third Quarter FY 1988

ASET II will be the follow-on desktop trainer to ASET I. It will provide both tutorial and flight modes of instruction. ASET II will be used solely as an in-unit training device. This will allow for greater internal memory storage with faster processing. Furthermore, it is to be fielded down to the unit level which will resolve the accessibility problem of ASET I.

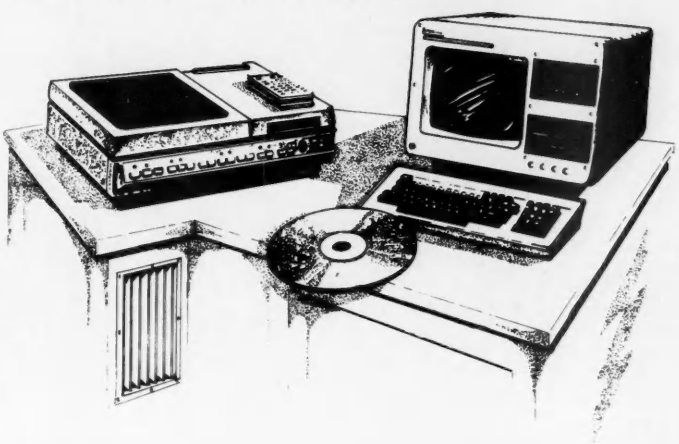
The Electronic Information Delivery System (EIDS) will be used as the hardware for ASET II. EIDS is being developed to standardize microcomputer video-based training devices. By using EIDS, development time will be drastically reduced and the system will be fully integrated into the logistics support system. Furthermore, the Army Aviation community will not have to take a degradation in training capabilities to use EIDS.

As mentioned earlier, the computer software used on ASET I will be the base for the ASET II program. This will provide a much better training program than ASET I because all noted shortcomings of the ASET I program will be corrected. Furthermore, the programs will be expanded to provide additional Threat/ASE data and hopefully provide the opportunity for training ASE repair personnel also.

ASET II will be used at the U.S. Army Aviation Center, Ft. Rucker, AL, for institutional training and used in the field for sustainment training. By using the computer as a training aid, the student is not exposed to just the minimum objectives; he has the opportunity to advance as far as he desires into the understanding of Threat and ASE. This will greatly enhance the unit threat officer's program.

Like everything else, the Army's training program has limited funds. For this reason, maximum training must be accomplished on the ground, conserving flying hours for those tasks that can only be taught in the air. The combination training offered by these devices will ensure that for each hour spent in the air, maximum learning and combined skills training will be available.

Artist conception of EIDS which will support ASET II program.



ASET III

Ready for Training, June 1988

ASET III will be used to provide in-flight ASE training on an individual basis to aviators. Specifications for the device require it to be user friendly, lightweight and low cost, which will allow for distribution to the unit level.

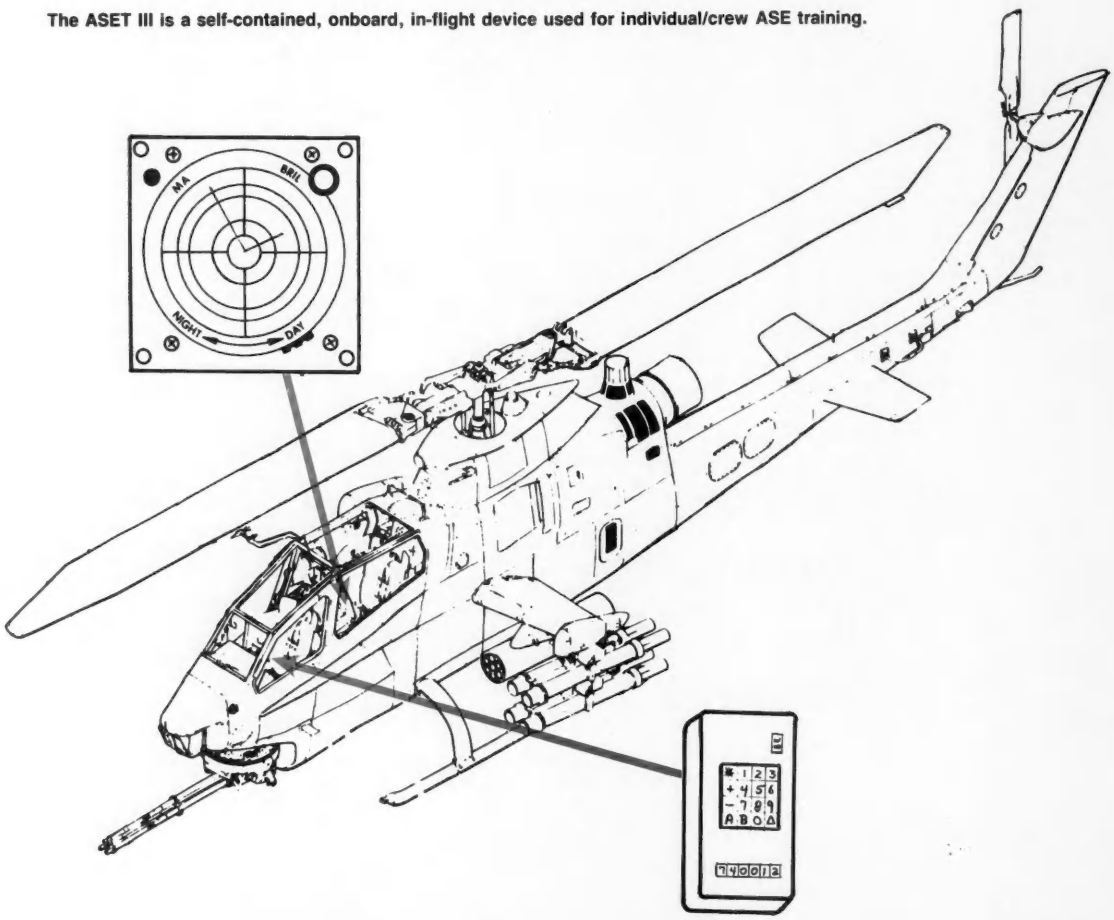
Programing of the device to simulate threats on the AN/APR-39 CRT may be done prior to the flight. During the flight, the instructor pilot (IP) will be able to activate the desired threat by the push of a button. This will allow the IP's attention to be focused toward the training of the pilot and safe operation of the aircraft. The ASET III will allow the pilot to demonstrate lessons learned with ASET I and/or ASET II while operating the aircraft and proper ASE controls.

ASET IV

Ready for Training, FY 1989

The ASET IV family will bring all the training the pilots have received on survival and mission accomplishment in an electronic warfare environment together. This device or group of devices will not only provide the opportunity for the pilot to fly against

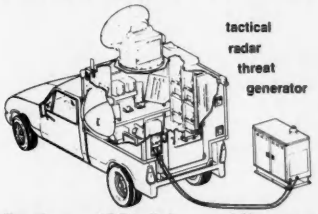
The ASET III is a self-contained, onboard, in-flight device used for individual/crew ASE training.



threat systems, trying to avoid detection, but it will also allow him to employ his tactics training to simulate killing the Threat (for attack aircraft) or being killed if errors are made. It is not enough to tell an individual what has happened after the fact — real time casualty assessment must be available. Furthermore, an explanation of errors must be available to improve skills. For this reason, event recording will be provided by ASET IV.

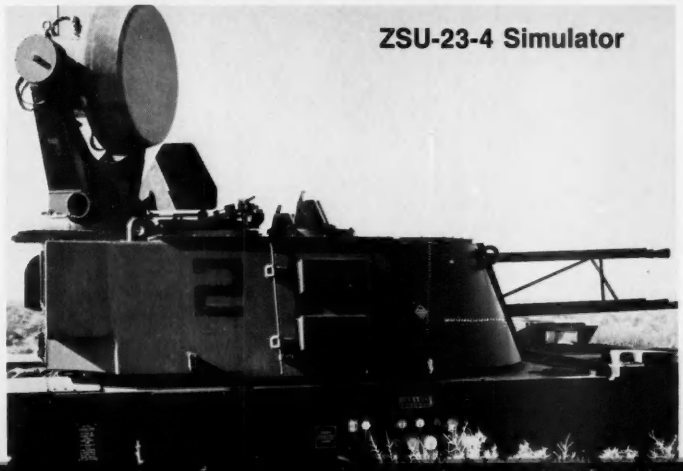
The means by which this is to be accomplished is through the development of ground-based threat simulators. These simulators will provide a selected array of threat systems that will be mobile and produce radar, infrared and ballistic simulation. This will provide experience necessary to obtain the skills of a seasoned combat aviator without the risk of loss of life or equipment. The devices will be designed along the modular concept so growth and system updates will be simple in nature.

The front-runner of the ASET IV was the tactical radar threat generator (TRTG), formerly GRETA, fielded in



fiscal year 1981. It is a mobile ground radar emitter which generates threat radar characteristics similar to those expected to be encountered on a modern-day battlefield. The system simulates search, acquisition and track modes of operation on the AN/APR-39. This provides the opportunity for the pilot to practice countermeasures against the radar threat. There are currently four TRTGs fielded. Five more devices will be fielded beginning May 1986, which will bring the total to nine.

These simulators were developed for test purposes by the Army Development and Acquisition of Threat Simulators Division, Ft. Bliss, TX. They are very detailed, complex systems. For training purposes we do not need this amount of fidelity. However, the ASET IV systems will be distinctive in appearance and cause ASE to respond properly, thus achieving the maximum training benefits per training dollar.



The Outlook

The Army began fielding the Multiple Integrated Laser Engagement System/Air-to-Ground Engagement Simulation-Air Defense (MILES/AGES-AD) in December 1983. This system provides real-time, automatic casualty assessment for force-on-force combat training exercises. The system simulates the weapon system as to range and probability of kill; however, the countermeasures capability of ASE was not incorporated into the equation at that time. The development of MILES/AGES for the AH-64 Apache, UH-60 Black Hawk, CH-47 and OH-58D (MILES/AGES II) will have the ASE data fed into the hit/kill factors. The development of the capability is planned to be backfed into the original MILES/AGES-AD system. This will allow both aviation and air defense communities to train to the full extent of their equipment.

LEFT: MILES/AGES on the AH-1 Cobra. Note modified rocket pods and 20 mm system.

BELOW: MILES Stinger simulator used in air defense role for force-on-force training exercises.

The ASET family will greatly enhance Threat and ASE training; however, with ingenuity, unlimited positive training can be accomplished today using existing training assets. An example would be the installation of an armored personnel carrier MILES kit on the shelter housing of the TRTG with a MILES laser transmitter mounted adjacent to and boresighted with the TRTG camera, capable of emitting at the command of the operator. To a lesser degree, a MILES equipment Stinger team could be employed with the TRTG, firing on the command of the TRTG operator for radar threat or on his own initiative for infrared threat.

Remember that you will fight as you are trained. If you do not train properly during peacetime, you will not have sufficient time to upgrade during combat. It is the responsibility of all pilots, in particular the IPs and the unit training officers, to develop programs to ensure adequate training.

I have provided you with data on what is available now and what is planned for the future. The Aviation Center is also working diligently to provide training guidance in the fields of Threat and ASE. If you have Threat or ASE training problems, assistance may be obtained by contacting: Commander, USAAVNC, ATTN: ATZQ-TD-ST-ASE, Ft. Rucker, AL 36362-5000 or by calling AUTOVON 558-4110 or Commercial (205) 255-4110.

GOAL—
$2,500,000

MARCH 1986—
$1,925,000
CASH AND PLEDGES

Army Aviation MUSEUM

This is a series about the Army Aviation Museum Foundation fund drive. Currently, plans call for building a modern complex to house your Army Aviation Museum. Since last month additional donations have been received. However, we still have a ways to go, as the barometer above shows. If you would like to help "build" the Army Aviation Museum's new home, you are invited to send a tax deductible contribution to: The Army Aviation Museum Foundation, Box 610, Ft. Rucker, AL 36362-5000. If you desire additional information call Mr. Ed Brown at (205) 598-2508.

A Look At What's In Your Museum

YH-32 Hornet

Hiller Aircraft Corporation was granted a contract by the U.S. Navy in 1950 to develop a simplified jet power plant for rotary wing aircraft. In 1951, they developed the Hornet and announced that it would be the "world's first practical low-cost rotary wing aircraft." The ramjets, one on each rotor blade, weighing 12.7 pounds each produced 40 pounds of thrust at 550 rotor revolutions per minute (rpm). However, before the jets could be started the main rotor had to be rotated up to 50 rpm either by a hand crank or a gasoline engine.

In 1953, the Army purchased 2 for testing in the light observation class and later procured 12 more for further evaluation. The engine, approved in October 1954, became the first ramjet powered unit certified in the United States and also the first Civil Aeronautics Administration approved rotor tip-mounted power plant for helicopters. Although the Hornet proved successful, it did not become a part of the Army's inventory because of noise, fuel consumption and range. The YH-32A displayed was the first of the two tested by the Army and was transferred from the Transportation Aircraft Test and Support Activity to the U.S. Army Aviation Museum in 1960.

AVIATION LOGISTICS

HIGH FMC RATES—SIMPLE MATH

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Directorate of Combat Developments
U.S. Army Aviation Logistics School
Fort Eustis, VA

TO ASSESS THE value of people in an aircraft maintenance operation is to assess the extent to which available man-hours contribute to aircraft fully mission capable (FMC) rates.

Logically, to maximize FMC rates we need to maximize the number of man-hours spent on direct accomplishment of maintenance tasks, or direct productive man-hours (DPMH). The natural inclination when seeking an increase in the total number of direct productive man-hours is to seek an increase in the total number of people authorized—simple math.

But is it that simple? In translating a need for more direct, productive man-hours to a need for more people, maintenance officers and supervisors often fail to address the fact that *there is another more immediate alternative:* Increase the number of direct productive man-hours *by decreasing* the number of *indirect* productive man-hours (IPMH).

Reviewing the different "type" man-hours that make up the 24-hour day (as our functional table of organization and equipment (TOE) developers see it), we find that DPMH, as previously mentioned, are those spent in actual performance of aircraft maintenance tasks, frequently called "touch" time, or "hands-on" time. Indirect productive man-hours are the hours expended on functions supporting DPMH tasks, such as moving aircraft to maintenance areas, going after tools and requisitioning repair parts. Finally, nonproductive man-hours (NPMH) comprise those hours consumed by activities unrelated to accomplishment of either DPMH or IPMH tasks (sleep, details, leave, sick, etc.).

Among all units having the same number of people performing the same kind of work, odds are that DPMH times spent on individual tasks will be relatively uniform, because they rely on the technical skills of assigned personnel and, generally, all personnel come from the same training source. Also, NPMH will be relatively consistent among like units, since they all contend with the same factors that make up that category. Essentially, both DPMH individual task times and NPMH expenditures are beyond the control of the unit maintenance officer. However, IPMH times are a different story. That is one area we can alter to sway things in our favor.

"Aha," says Captain Emmo, "IPMH task times are statistically determined through time-in-motion studies and the like, and are not changeable either." He then proceeds to explain how IPMH times are formulated. Using the example of moving an aircraft from the flight line to the hangar for maintenance, he draws up the following step-by-step sequence of events involved in arriving at total time for that IPMH task:

STEP 1:	**Open hangar doors.**	**2 people, 1 minute =**	**2 man-minutes**
STEP 2:	**Go get assigned towing vehicle (tug).**	**1 person, 5 minutes =**	**5 man-minutes**
STEP 3:	**Drive tug to aircraft and hook up aircraft.**	**2 people, 5 minutes =**	**10 man-minutes**
STEP 4:	**Tow aircraft to hangar and disconnect it from tug.**	**2 people, 10 minutes =**	**20 man-minutes**

STEP 5: Return tug to parking place.	**1 person, 5 minutes =**	**5 man-minutes**
STEP 6: Close hangar doors.	**2 people, 1 minute =**	**2 man-minutes**
	Total man-minutes	**44**

"Aha," I say. "The tug doesn't work. Also, the hangar door track is rusted and has a little warp in it." Thus, I present my own sequence of events:

STEP 1: Round up 6 people.	**1 person, 5 minutes =**	**5 man-minutes**
STEP 2: Open hangar doors.	**6 people, 2 minutes =**	**12 man-minutes**
STEP 3: Walk to aircraft and prepare to push it.	**6 people, 5 minutes =**	**30 man-minutes**

Now we find that the unit has only two operational ground handling wheel sets out of eight authorized, and both sets are in use (and if you think that's unusual, talk to a few wrenchbenders).

STEP 4: Wait for ground handling wheels.	**6 people, 10 minutes =**	**60 man-minutes**
STEP 5: Push aircraft to hangar.	**6 people, 12 minutes =**	**72 man-minutes**
STEP 6: Close hangar doors.	**6 people, 2 minutes =**	**12 man-minutes**
STEP 7: Return to original work assignments.	**6 people, 2 minutes =**	**12 man-minutes**
	Total man-minutes	**203**

So, we see that inadequately maintained facilities and equipment can easily generate an IPMH *increase* of almost 3 man-hours to perform one simple task. Additionally, this statistic does not take into account the DPMH lost on other aircraft originally being worked on by the "pushers," and the irritation factor brought into play by the interruption of *their* work.

This is by no means a worst-case example of facility and equipment problems inflating IPMH levels. Literally hundreds of variations occur every day throughout the Army (three aircraft simultaneously require starting or powered maintenance and only one of three assigned auxiliary power units is operational; needed hydraulic stands and jacks sit useless in the back of the hangar because of popped seals and "something else" must be used in their place, ad infinitum).

Another villain in the saga of high IPMH levels is the tendency for some maintenance types to downplay the perceived "little things" in day-to-day operations. Everybody and his dog will go all-out to round up an engine to get an aircraft back in the air. A plethora of management actions will be applied to ensure that everything has been done to get a hold of this intensively managed item as quickly as possible.

But what about the ½-inch bolts that are needed to attach a part to the engine? Probably cost less than a dollar apiece and are in the supply system by the thousands. Unfortunately (if you watch for such things) it is not at all unusual to see a repairman go to the common hardware bin and rifle through 25 or 30 drawers before finding the bolt he needs. Result: 30 minutes to find the bolt, 30 seconds to install it. And that 30 minutes of bolt searching time holds the aircraft just as close to the ground as does the faulty engine. In this instance, unnecessary IPMH and aircraft downtime occur because no rapid common hardware location system has been established; and no controls are imposed to keep the hardware storage bins in order.

Again, case after case of inadequate day-to-day management systems could be presented. Situations such as the search for hardware (looking for tools, finding current reference manuals, hunting misplaced logbooks, etc.) have become such commonplace events in some organizations that maintenance personnel, including supervisors, accept them as a way of life.

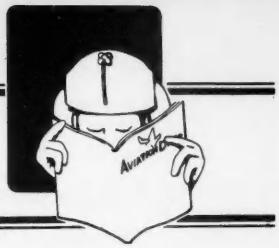
Given the number of Army aircraft worldwide, the number of maintenance tasks performed every day, and the number of days in a year, the above examples soon balloon into mega-IPMH time. Meanwhile, our TOE developers continue to staff units based on IPMH factors established from time-in-motion figures that were predicated on "normal" conditions: *Everything works, a place for everything and everything in its place.*

The *real* mathematics of the case is that total DPMH time is inversely proportional to total IPMH time. Reducing the time consumed by IPMH inherently generates a capability to increase the time available for DPMH by an equal amount, and high DPMH availability is the bread and butter of maintaining high aircraft FMC rates.

It is virtually impossible to list the multitude of situations that contribute to unnecessary IPMH expenditures throughout Army Aviation each day. The objective of this article is to proffer the theory that it is not management of the "big" things that normally gives one unit better aircraft FMC rates than another; *everyone manages the big things.* It is the expenditure of effort on managing so-called "little" things—care of ground support equipment, facilities, systems for day-to-day operations—that makes the difference. The theory might best be postulated as follows:

As IPMH time decreases, DPMH time increases; as DPMH time increases, FMC rate increases; as FMC rate increases, chances of winning the battle and chances of getting promoted increase. And, *that* is simple math.

VIEWS FROM READERS



Editor:

I have been reading the *Aviation Digest* for more than 15 years now. And, it is one of the most informative magazines around.

However, I think that it is time for one change. I remember when the *Aviation Digest* started covering the Black Hawk emblem (bird) on the front cover and inside it. I feel that it is time for it to go.

Now that we are our own branch, it should carry the branch logo on it. Not all of us are impressed with the Black Hawk logo now after about 6 years of seeing it. Thanks for your time and please give it some thought.

SSG Jerry Howell
CH-47D 66UY1 Instructor
Ft. Eustis, VA

The hawk (above left) used on the outside masthead and inside front cover is not intended to represent the UH-60 Black Hawk. The Black Hawk logo (above right) and the* Aviation Digest *masthead with its hawk were developed independently of each other. They were (and are) not intended as emblems for each other. Their resemblance is strictly coincidental.

The commanding general's "page one" of the October 1979 issue introduced the hawk on the new masthead as representative of Army Aviation today. The hawk is indicative of the fighting spirit of Army Aviation units as members of their own branch, the combat arms and especially the maneuver arms.

The page one article described the hawk as a "magnificent bird of prey that uses its strength, quickness and the element of surprise to outmaneuver its opposition." This reflects the characteristics of all elements of Army Aviation.

Editor:

Due to unforeseen circumstances it has been necessary for us to change the dates of the reunion of the 11th Armored Cavalry Regiment (BLACKHORSE). Now, the 1986 11th Armored Cavalry Regiment (BLACKHORSE) Reunion, to be held at Ft. Knox, KY, has been changed from 9 to 10, to 16 to 17 May 1986. For reservations please contact me at P.O. Box 11, Ft. Knox, KY 40121 (or call 502-624-2247).

We are very sorry for the inconvenience that we may have caused anyone and sincerely do appreciate your help in this matter.

Bill Squires

Editor:

We would like to obtain copies of the following articles published in the *Aviation Digest.*

"ALFA Agency," March 1985

"Joint Attack of the Second Echelon," April 1985

"Joint Tactical Deception," May 1985

"Joint-Rear Battle," June 1985

"Joint Application of Firepower (J-Fire)," July 1985

Thank you for your quick response to this request.

Joan Willa
NASA-Ames Research Center
Moffett Field, CA

Editor:

The Aeromedical Safety Unit attached to this command has the responsibility of instructing all USN/USMC WESTPAC aircrews in the hazards associated with the psysiological aspects of flight. Due to the unique situation concerning the proximity of USN and USA commands, our instructors come into contact with U.S. Army aircrews. It would be a great asset to have our instructors familiar with current Army Aviation news, as well as past trends.

It is requested that the following address be placed on the *U.S. Army Aviation Digest* automatic distribution list. It is also requested that an entire library of past issues be forwarded for inclusion to the AMSU technical library. Point of contact is Aeromedical Safety Unit, ATTN: HM2 Hawkins, USAF Clinic Kadena/SGT, APO San Francisco 96239-5300.

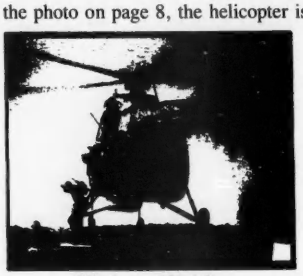
R.L. Berkley
1st Marine Aircraft Wing
Fleet Marine Force
FPO San Francisco

I regret that I cannot place you on official distribution from this office. All official distribution of the* U.S. Army Aviation Digest *is handled in Washington, DC. Marine Corps units can obtain distribution of the* Aviation Digest *by requesting it from: Commandant of the Marine Corps, HQSP-2, Washington, DC 20380.

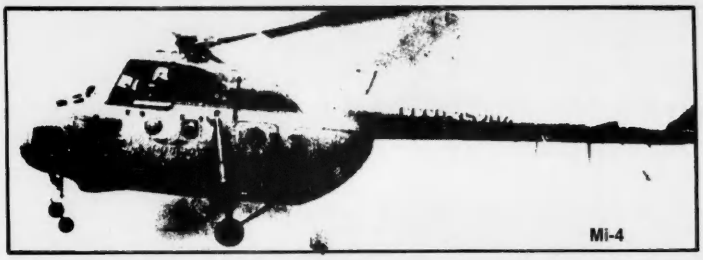
However, I am sending under separate cover available back issues of the* U.S. Army Aviation Digest *for your library.

Editor:

I am a Redeye/Stinger team chief, and I have studied U.S., Soviet and NATO aircraft for more than 4 years. I feel there was an error in the November 1985 issue. In the photo on page 8, the helicopter is



Mi-4 or Mi-8?



Mi-4

not an Mi-8 Hip but a Soviet Mi-4 Hound. Despite this minor error, I did find the article very interesting.

SGT Tommy A. Jenkins
Redeye Team Chief (ADA)
Ft. Sill, OK

You are absolutely right Sergeant Jenkins; "Good eye!" Here are the Mi-4 and Mi-8 helicopters. The two front wheels should give the Mi-4 away, because the Mi-8 has only one front wheel. What other features enable you to distinguish between the two helicopters? Write us and we will print correct responses.

Mi-8

Editor:

Would you please send me two each of the following articles:

- "Training the Aviation Warrant and Commissioned Officers," March 1984.
- "Aviation Officer Basic Course," April 1984.
- "Warrant Officer Candidate Military Development Course," April 1984.
- "The Officer/Warrant Officer Rotary Wing Aviator Course," May 1984.

Thank you. My friend and I are currently studying the (AH-64) Apache helicopter. The above information will help us in our studies to become warrant officers.

PVT Daniel Pontius
Ft. Eustis, VA

For additioal guidance see DA Pamphlet 95-1 and Army Regulation 611-85.

Editor:

We are writing in regard to back issues of the *Aviation Digest*, and in particular the PEARL'S articles printed therein.

We're trying to obtain back issues of PEARL'S and would highly appreciate it if you could print the following notice.

If anyone has any extra copies of these issues (below) we would be thankful if they would send us a copy: (The *Aviation Digest* is out of these back issues):

1970—JAN, FEB, MAR, APR, JUL AUG, SEP, OCT, NOV, DEC
1971—JAN, MAY, JUL, AUG, SEP, OCT, NOV, DEC
1972—APR, JUL, OCT, NOV
1973—MAR, APR, MAY, NOV
1974—FEB, MAR, MAY, JUN, JUL, AUG, SEP, OCT, DEC.

We do have complete issues from January 1975 to September 1985. Anyone interested in obtaining copies of these issues of *Aviation Digest* and/or articles of PEARL'S, may contact us by writing to: CDR, HHC 101st AVN GP, ATTN: Div ALSE OIC: CW2 Barry D. Carlander, Ft. Campbell, KY 42223-5000, or call AUTOVON: 635-2573/5531.

We sincerely thank you for your assistance.

CW2 Barry D. Carlander
Div ALSE Officer

Editor:

The General Aviation and Space Technology trade show will be held on 15 and 16 June 1986 at the Northwest Aviation and Space Expo, Boeing Field International Airport, Seattle, WA. It is sponsored by the Pacific Science Center. For more information write Robert Slagle, 7277 Perimeter Road South, Seattle, WA 98108, or call (206) 763-8560.

Robert Slagle
Executive Director

Editor:

Please send a copy of "Joint Application of Firepower (J-Fire)" which appeared in the July 1985 issue as part of a series of articles about the projects of the Air-Land Forces Application Agency.

MAJ Larry M. Jonas
Team Chief, Rear Area Battle Staff
HHC, 7th SUPCOM
APO New York

Editor:

I read in the September issue of *Aviation Digest* that I might obtain a copy of the article by MG John W. Foss that appeared in your August 1985 issue.

Apparently my August issue never got to me. Since this series of articles [about the maneuver arms—Armor, Infantry and Aviation] is very informative and useful, would you please send me a copy of General Foss' article.

COL John E. McCleary (Ret)
Westlake Village, CA

Editor:

Request one copy of the following ALFA articles as described in the October 1985 issue of the *U. S. Army Aviation Digest:*

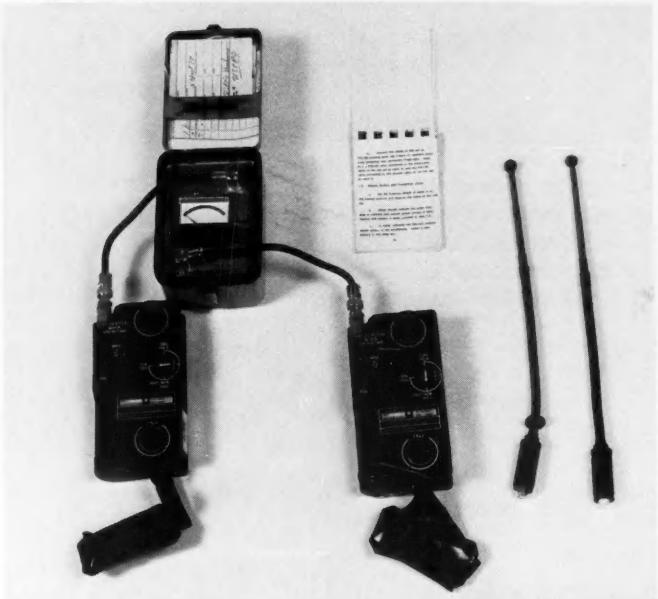
"ALFA Agency,"—March 1985
"Joint Attack of the Second Echelon," —April 1985
"Joint Tactical Deception,"—May 1985
"Joint-Rear Battle,"—June 1985
"Joint Application of Firepower (J-Fire),"—July 1985

John Maguire
HQ 472d Chemical Battalion
(Smoke Generator)
Chicago, IL

Articles from the Aviation Digest requested in these letters have been mailed. Readers can obtain copies of material printed in any issue by writing to: Editor, U.S. Army Aviation Digest, P.O. Box 699, Ft. Rucker, AL 36362-5000.

PEARL'S

Personal Equipment And Rescue/survival Lowdown



photos by Benjamin Martel

This month's PEARL Dawna Salazar introduces the AN/PRM-32 radio test set. At right is a view of the AN/PRM-32 radio tester (equipped with two emergency frequencies with the capability to transmit and receive on both frequencies); two PRC-90 radios with earphones attached; the operating instruction pamphlet; and two antennas (disconnected). Radios are required to be inspected with the AN/PRM-32 radio test set every 30 days at the unit level. Also necessary is a 120-day inspection using a different radio tester that is normally done at higher than unit level. The advantage of using the test equipment is that the emergency frequency can be tested without actually transmitting over the air and disturbing routine radio transmissions.

Nameplates for Nomex Flight Suits

There is a new thrust using name plates on Nomex flight suits/clothing. The following article supersedes information published in Part III, Item 24 of the U. S. Army Support Activity Supply Digest No. 1-85, dated March 1985:

Enlisted aircrew personnel can secure nameplates for the Nomex flight suits without cost to the individual. AR

670-1, paragraph 10-10, provides the necessary details. Authorization document is CTA 50-900, line item number 84140N, plate, name, black with white lettering.

Plastic/leather nameplates do not have a stock number or part number. The following is a partial list of commercial sources where they can be obtained:

KEN NOLAN, INC.
16901 Milliken Ave
P. O. Box C-19555
Irvin, CA 92713
Com (714) 863-1531

DENMARK MILITARY
636 Broadway
New York, NY 10012
Com (212) 677-4332

HOLLICKS
P. O. Box 264
College Station,
TX 77840
Com (409) 846-6721

Minimum order: At least four with same name. The e is no minimum order without name.
NOTE: If unable to obtain commercially, a DD Form 1346-6 may be mailed to:

Commander
Defense Personnel Support Center
ATTN: DPSC-TSKR
2800 South 20th Street
Philadelphia, PA 19101-8419

The routing identifier code is S9T. In the remarks block, fully describe the item and give the soldier's name.

This information is a reprint from USASPTAP's Supply Digest No. 4-85.

Sleeping Bag, Arctic Survival, Vacuum Packed

A limited quantity of sleeping bags, NSN 8465-01-131-7921, 1-Lot, is available to be used by aviation life support equipment (ALSE) training schools for cold weather training. Subject lot was rejected for end item use because of the CLO value. Subsequently, these sleeping bags were determined viable for training use only. *Bags must be clearly marked as follows:*

- Training sleeping bags, not to be used in aviation life support survival kits.
- Sleeping bags are not to be used in temperatures lower than -15 degrees Fahrenheit.
- Bags are not to be repacked after use.

Funded requisitions should now be submitted to DPSC RIC S9T citing project code "CWT" in card column 57-59.

Problems related to above action should be brought to the attention of DPSC point of contact, Minnie Chamberlain, AUTOVON 444-3195, ATTN: DPSC-TE, 2800 South 20th Street, Philadelphia, PA 19101-8419. This is a reprint of USASPTAP's Supply Digest No. 4-85.

C-12 Survival Kit

The contractor furnished C-12 survival kit was assembled with essential survival components to cover as many survival situations as possible. However, it is recommended that the C-12 survival kit for cold and hot weather conditions be supplemented as follows:

Cold Weather Add-On Equipment

7340-00-170-8374	Spoon, plastic, 10 each
8465-01-131-7921*	Bag, sleeping
6850-00-985-7166	Water purification tablets, iodine, 3 bottles
8340-00-485-3012	Tarpaulin, 7 feet x 11 feet, 1 each

*There should be one sleeping bag for each individual onboard aircraft.

Hot Weather Add-On Equipment

7340-00-170-8374	Spoon, plastic, 10 each
6850-00-985-7166	Water purification tablets, iodine, 3 bottles
8340-00-485-3012	Tarpaulin, 7 feet x 11 feet, 1 each

This equipment can be stowed on the aircraft in a separate container. The container should be marked "survival kit" and should be stowed adjacent to the standard kit.

AMMO Permanent Suspension

Newly trained ALSE specialists have recently discovered quantities of condemned signal kits in their units' survival vests. These signal kits, personnel distress, NSN 1370-00-490-7362, all "OL" lots manufactured prior to 1975 were permanently suspended by ARRCOM message 0616567Z Oct 81 and all "MBA" lots manufactured prior to 1981 were permanently suspended by ARRCOM message 051432Z Jan 82.

It appears some ALSE specialists did not get the message the first time around. Continual vigilance will assure that only the correct and serviceable components are installed in survival kits and vests.

If further information is needed, point of contact is "Boone" Hopkins, AMCPM-ALSE, AUTOVON 693-3181 or Commercial (314) 263-3818.

If you have a question about personal equipment or rescue/survival gear, write PEARL, AMC Project Officer, ATTN: AMCPO-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 or call AUTOVON 693-1218/9 or Commercial 314-263-1218/9.

Smoking:

The Choice Is Yours

U.S. ARMY SAFETY CENTER

NOT ANOTHER sermon on smoking! No, just some information you might want to consider when you make your choice. No medical warning or safety article is going to make you stop smoking. You do need to know the physiological effects, however, because they can make some difference in your performance as an aviator.

Vision

Night myopia occurs when the lens of the eye loses elasticity so that the light wavelengths most common at night cannot be focused exactly on the retina. This usually occurs when people are in their late 20s or early 30s, but it can occur earlier or later. A person with 20/20 daylight vision may have only 20/40 night vision because of night myopia. There really isn't anything you can do about that, but there is something you can do that will make it worse, and that is smoking.

Carbon monoxide in cigarette smoke combines tightly with hemoglobin molecules in your blood. The job of these molecules is to transport oxygen to the body's cells, a job they can't do when they are saturated with carbon monoxide. Cells in the retina which supply night vision are sensitive to even slight decreases in the amount of oxygen supplied to them. LT R. J. Seymore,

MC(FS), U.S. Navy, writing in *Approach* magazine says, "The average one-pack-a-day smoker walks around with between 2 percent to 15 percent of his hemoglobin (oxygen transport) molecules saturated with carbon monoxide." While some medical researchers estimate the percentage of saturation to be less, they all agree that carbon monoxide degrades night vision acuity.

MIL-STD-1472C, 2 May 1981, states that personnel shall not be exposed to concentrations of carbon monoxide in excess of values which will result in carboxyhemoglobin (COHb) levels in their blood greater than the following: 5 percent COHb (all system design objectives and aviation system performance limits); 10 percent COHb (all other system performance limits). That means the Army doesn't want you flying its aircraft if your blood shows more than 5 percent COHb, and you shouldn't be operating a tank or driving a truck if it is more than 10 percent.

Why is the acceptable percentage for aviators only half that for soldiers operating other types of equipment? Military Handbook 759A says, "Some findings provide the assurance that nonsmoking, healthy soldiers will not experience any significant effects on mental acuity or physical ability which are attributable to carbon monoxide exposures providing COHb levels up to 10 percent nor is their health impaired by such exposures. However, other experimental evidence suggests that visual acuity may degrade at or below COHb levels of approximately 5 percent. Because of both the uncertainties evident in the research findings and the criticality of certain crew tasks involving visual perception (e.g., helicopter nap-of-the-earth flight and night flight operations), both the systems design objective for all systems and the performance limit for aviation systems is specified to be a COHb level of 5 percent or less in MIL-STD-1472C."

There is very little most of us can do about the quality of air we breathe all day. Industrial plants, automobile exhausts, even our home heating systems, all contribute to the amount of carbon monoxide we breathe. The National Ambient Air Quality Standards established by the Evironmental Protection Agency allow a carbon monoxide concentration of 9 parts per million. So, even "clean" air generally results in blood carbon monoxide levels greater than 1.5 percent after 8 hours of exposure.

One variable we can control, however, is smoking. Smoking a pack of cigarettes a day, even by conservative medical research figures, means an additional 2 to 6 percent of our hemoglobin molecules are made ineffective. Even if no more carbon monoxide is added from any other sources, that is enough to affect night vision.

Most Army Aviation operations take place at low altitudes; however, aviators who smoke need to know that when they fly at high altitudes they may need supplemental oxygen sooner than aviators who don't smoke. Decreased oxygen to the retina at high altitudes can cause blood vessels to twist and swell. At around 13,000 feet the result can be high altitude retinal hemorrhage when those swollen vessels rupture. Since this phenomenon is a function of hypoxia, rather than altitude itself, use of supplemental oxygen should provide protection.

Hearing

Smoking can also affect your ears and hearing. One U.S. Air Force UH-60 crew was descending from 13,000 feet when the flight engineer suffered an earblock. As the aircraft leveled off, he was able to clear his ears, but when the pilot continued a shallow descent, it happened again. By the time the aircraft landed, he had experienced four or five more episodes of earblock. The flight surgeon attributed the earblock to several factors. First among them was the fact that the flight engineer was a cigar smoker. The cigar smoke irritated his throat and eustachian tubes, and their swelling caused the earblocks. The flight engineer quit smoking, and he had no further incidents.

Navy researchers looked at 675 pilots and flight crewmembers whose medical histories had been taken regularly since 1940. About 85 percent of these people had been exposed to at least 5 years of aviation noise; the average length of exposure was 14.4 years. The researchers identified 97 people with very good hearing and 104 people with considerable hearing loss. They then attempted to identify common nonauditory factors that might be used to predict who would wind up in the high-loss group. Two factors emerged: eye color and smoking history.

The smoking index (packs per day multiplied by years smoked) of the impaired hearing group was 32.8. It was only 25.8 for the unimpaired group, a statistically significant difference.

The mechanisms by which smoking might impair hearing include lowering the oxygen level, which could cause inner ear damage, or cause spasm of the inner ear blood vessels, thereby damaging delicate hearing tissues.

The relationship of eye color and hearing loss may lie with a substance called melanin. Melanin is the stuff that makes people tan in the sun. It is also responsible for eye coloration. It's thought that a high level of melanin, indicated by brown eyes, may also signal high melanin content in certain parts of the hearing structure where it provides a protective effect against the ravages of high noise levels. It acts as a kind of built-in earplug.

The color of your eyes is something you will have to live with, but you blue, gray,

or green-eyed aviators might want to know that you are even more susceptible to hearing loss if you smoke.

Memory

Experiments have demonstrated that smokers do less well than nonsmokers on short-term memory tests when they smoke right *before* trying to learn the material.

Two University of Oxford researchers tested 15 nonsmokers and 54 smokers to find out what happens to retention when smoking takes place *after* learning.

The drill consisted of learning a list of 10 word pairs and then being tested for memory of the list half-an-hour, one day, one week, and one month later. When tested after one-half hour, nonsmokers were way ahead of all smokers on memory recall. This difference tended to lessen with time.

The smokers had been subdivided into four groups. One group was deprived of a cigarette immediately after first learning the word list; the other three groups smoked a cigarette immediately with low, medium, and high nicotine content.

Memory recall of the low and middle nicotine groups improved at the end of one week while the smokers who had been deprived of a cigarette and those who smoked cigarettes with high nicotine content still lagged behind.

Smoking and exercise

Shortly after work, a 27-year-old Army medical technician died of a heart attack. He was trim, in good health, and he exercised regularly. He also had a three-pack-a-day cigarette habit. His smoking normally caused no problems with his daily 45-minute workout routine. On the day he died, however, he had an unusual reaction; he felt dizzy and weak. He went to a medical clinic and asked for a checkup; as the examination started, he collapsed. Efforts to revive him failed. What happened?

Dr. (COL) George Ward, Jr. said that several years ago sudden deaths were reported of healthy adults, including some who were highly-trained athletes, after participation in vigorous sports. Investigation showed they had taken high-protein liquid diets or amphetamines before engaging in sports.

Ward said certain nonnatural chemicals in the body can cause an irregular and sometimes fatal heartbeat. The extent of the effect depends on the quantity and substance involved. Liquid protein diets, amphetamines, barbiturates, alcohol and cigarette smoke in large doses all can have toxic effects.

Smoking more than two packs of cigarettes per day over a period of about 10 years can irritate the heart muscle, although patients may not detect these irregularities directly, Ward said. Dizziness, weakness or chest pains usually emerge as the first warning signs. The problem mainly affects males in their twenties, although there is no age limit. Smokers are three times as likely to have irregular heartbeats as nonsmokers, he added.

Effects of smoke on nonsmokers

The person who smokes isn't the only one affected by the smoke. The immediate effect on other people from a smoker's cigarette varies from intense for those who are allergic to smoke to mild (depending on the length of exposure).

The long-term effects may be more harmful, however, than was previously thought. The Surgeon General reports that nonsmokers in a room with smokers may inhale 3 to 5 mg of nicotine in an hour. Such people will have a blood carbon monoxide level equivalent to that of smoking one cigarette per hour.

The choice is yours

No one can decide for you whether you will smoke or how much you will smoke. You should be aware, however, of how smoking can affect you. That extra fine edge of vision, hearing, recall and overall good physical condition from giving up smoking could be the thing that prevents you from becoming another accident statistic.

Sources

Approach, April 1985, "Night Vision and the Naval Aviator," LT R.J. Seymore, MC(FS), Carrier Air Wing 7, NAS Oceana, VA.

Army News Service, Fall 1984, "Smoking and Exercise Make a Deadly Combination," Public Affairs Office, HQ, 7th Medical Command, U.S. Army Europe.

Aviation Safety, March 1, 1984, "Hypoxia and Retinal Hemorrhage"; July 1, 1984, "Smoking to Forget"; January 1, 1985, "When Bad Things Happen to Good Hearing."

MAC Flyer, April 1985, "Smoker's Lament."

MIL-STD-1472C, par. 5.13.7.4, 2 May 1981.

MIL-HDBK-759A, par 3.7.5, 30 June 1981.

National Center for Health Statistics Advanced Data, March 17, 1982, "Blood Carbon Monoxide Levels in Persons 3-74 Years of Age: United States, 1976-80a," U.S. Department of Health and Human Services, Edward P. Radford, M.D., University of Pittsburgh, and Terence A. Drizel, Division of Health Examination Statistics.

TAC Attack, March 1985, "When One Person Smokes, Everyone Smokes."

Enlisted Official Photographs

THE PHOTOGRAPH is an important part of the official military personnel file. It is of particular interest to Department of the Army Centralized Enlisted Selection Boards considering soldiers for promotion or schooling.

According to Sergeant Major Howard T. Rice of MILPERCEN's Enlisted Records and Evaluation Center at Ft. Benjamin Harrison, IN, the official photograph is the first document a board member sees.

"The photograph gives a first impression of a soldier's military bearing, physical condition and attention to detail," Rice said. "Board members review the photograph for haircut, uniform fit, insignia placement, posture and the arrangement of ribbons and badges."

A photograph's importance was emphasized when 1982 and 1983 boards requested that it be changed from microfiche to hard copy, or regular paper photo. Since March 1984, boards review photographs in hard copy.

"The soldier, chain of command and photographic facility share responsibility for the quality of official photos," Rice said. "The soldier and chain of command must make sure the photo is current. They also are responsible for the soldier's military appearance—things such as hair, weight, moustache and standing at attention," he continued. "They need to be sure the uniform fits and that it's pressed, that shoes are shined, and that sleeves, trousers and skirts are the correct length."

The soldier and chain of command also must see that the proper brass, crests, awards, badges, service stripes and other accoutrements are in the right places.

The photographer is responsible for proper lighting—making sure there are no shadows and no glare from eyeglasses. The photographer also positions the soldier and tapes the uniform in place for a sharp appearance. Photo background, size, focus and processing are photo lab responsibilities.

"These responsibilities should be used as a guide to prepare a soldier for taking an official photograph," Rice said. "The fact is that a photo lab cannot make a poorly-fitting, unpressed uniform look good. However, a photo lab can make a well-fitting, pressed uniform look better."

Ideally, a photo lab should send all photos to a soldier's sergeant major for checking, since a photo reflects on the chain of command's ability to train a soldier to wear the uniform correctly. Once the sergeant major is satisfied with a photo, the soldier should then ask himself, "Is this really me, is this how I want board members to see me?"

"The official photograph represents the soldier standing before the board," Rice explained. "When it no longer properly represents the soldier, a new photo should be taken."

Reasons for taking a new photo include promotion, a new ribbon, reassignment, and appointment to first sergeant. Selection board results show a strong correlation between having a current photograph and selection for promotion or schooling. During the fiscal year 1986 sergeant first class board, 98 percent of those selected had a current, hard copy photograph.

When a soldier's promotion packet is reviewed and the photo is missing, board members may feel that the soldier is hiding something, such as being overweight. A missing photo gives the impression a soldier is careless or unprepared.

"Competition is keen in today's Army," Rice said. "Soldiers cannot afford to let anything lessen their chances of being selected for promotion or schooling. While no one item will guarantee a soldier's selection, a missing photograph *can reduce* the chances. Don't leave anything to chance. Get a good official photograph taken and keep it current."

Forward two copies of your photo through the MILPO to Commander, USAEREC, ATTN: PCRE-BA, Ft. Benjamin Harrison, IN 46249-5301.

FC 1-216 Status Update

CW4 Marty L. Anderson
CW4 Dean M. Resch
CW4 David C. Marteney
Directorate of Evaluation and Standardization
U.S. Army Aviation Center
Fort Rucker, AL

Since the publication and implementation of the cargo helicopter aircrew training manual (ATM), Field Circular (FC) 1-216, in November 1984, many questions and comments concerning the ATM have been fielded by the Directorate of Evaluation and Standardization (DES) and the Aviation Training Brigade, United States Army Aviation Center, Ft. Rucker, AL. Within the last few months, numerous rumors and opinions have emerged concerning what changes are required and exactly what the current status of this publication might be. We will (attempt to) dispel any rumors and let you know what general changes are planned for the updated ATM.

On 27 February 1985, the responsibility to coordinate input, write and issue the ATM was transferred from DES to the Aviation Training Brigade.

FC 1-216 currently is being used as originally printed, without changes. Standardization communication (STACOM) messages have been issued in an attempt to clarify several areas in question. One of those areas was the standardization flight evaluation training gradeslips that were inadvertently inserted into the ATM during printing (see FC 1-216, figures 8-1 and 8-2). As stated in the STACOM, all cargo helicopter aviators should *continue to use the DA Form 4507-R gradeslips* until the corrected gradeslips can be fielded. Another area of concern was the conflict between Army Regulation (AR) 95-1 and FC 1-216 reference the reduction allowed to semiannual flight hour requirements through the use of the CH-47 synthetic flight training system. Until AR 95-1 is changed to correspond with the appropriate ATM, the *instructions contained in the ATM, FC 1-216 should be followed.*

Two major areas of interest noted during numerous trips to the field concerned the change of climb airspeed from 70 to 80 knots indicated airspeed (KIAS) (CH-47), and the number of tactical tasks listed as base tasks in the ATM.

First, with the introduction of the CH-47D and fiberglass rotor blades to our CH-47C fleet, a review of performance data, based on average fleet takeoff gross weights, showed the average rate of climb maximum endurance airspeeds increased to an average of 74 KIAS. Data gathered during actual flight evaluations (simulated power failures given during the takeoff/climbout at 70 KIAS) showed that the average pilot, while evaluating the cause of the power loss, tended to allow the airspeed to decrease slightly. This data indicated the need to fly the aircraft at an airspeed a few knots above the best rate of climb speed to compensate for pilot reaction time; this action may preclude an unsafe flight situation from developing.

Review of the base task list in FC 1-216 indicates that numerous mission profile tasks are incorporated with the base tasks required for cargo aircraft aviators. At this writing, it was anticipated that the current base task list would be reduced to include only those basic tasks required to safely pilot the aircraft. Previously, changes to ATMs most often occurred as a result of review conferences. These conferences

have been discontinued. As of now, changes to the ATM are made only through the DA Form 2028 system. Results of the recommended changes will be in a reprint of FC 1-216 (estimated to be fielded in 4th quarter fiscal year 1986).

The new FC 1-216 will be in the standard 8½ by 11 inch format and hole punched to fit the U.S. Government issue three-ring binder. Recommended changes to the ATM should be submitted promptly using DA Form 2028. Note that only *four* requests for change (DA Form 2028) have been received since FC 1-216 was fielded.

Recommended changes to the ATM should be addressed to: Aviation Training Brigade, ATTN: ATZQ-FT-O (ATM), Ft. Rucker, AL 36362-5000.

Comments concerning this article should be directed to: Commander, U.S. Army Aviation Center, Directorate of Evaluation and Standardization, Cargo Branch, Ft. Rucker, AL 36362-5000 (AUTOVON 558-6066/3504).

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362-5000; or call us at AUTOVON 558-3504, FTS 533-3504 or commercial 205-255-3504. After duty hours call Ft. Rucker Hotline, AUTOVON 558-6487 or 205-255-6487 and leave a message.

U.S. Army Class A Aviation Flight Mishaps

	Number	Flying Hours (estimated)	Rate	Fatalities	Total Cost (in millions)
FY 85 (to 28 February)	20	581,338	3.44	10	$38.8
FY 86 (to 28 February)	15	586,908	2.56	8	$27.9

HOTLINE

The following HOTLINE numbers can be called on official business after duty hours. They will be updated and reprinted here periodically for your convenience. If your agency has a HOTLINE it would like included, please send it to *Aviation Digest*, P.O. Box 699, Ft. Rucker, AL 36362-5000.

		FTS	AUTOVON	Commercial
Armor	Ft. Knox, KY	354-8265	464-8265	502-624-8265
Aviation	Ft. Rucker, AL	533-6487	558-6487	205-255-6487
Aviation Logistics	Ft. Eustis, VA	988-6166	927-6166	804-878-6166
Camouflage	Ft. Belvoir, VA	None	354-2654	703-664-2654
Center for Army Lessons Earned	Ft. Leavenworth, KS	753-2255	552-2255	913-684-2255
Chemical	Ft. McClellan, AL	538-5133/5592	865-5133/5592	205-238-5133/5592
Engineer	Ft. Belvoir, VA	None	354-3646	703-664-3646
Field Artillery, ARTEP	Ft. Sill, OK	None	639-2064	405-351-5004
Field Artillery, Redleg	Ft. Sill, OK	None	639-4020	405-351-4020
Fuels and Lubricants	R&D Center, Ft. Belvoir, VA	None	354-3576	703-664-3576
Ground Power Units	Tooele Army Depot, UT	None	790-2129	801-833-2129
Health Sciences, Training	Ft. Sam Houston, TX	None	471-4785	512-221-4785
Infantry, ARTEP	Ft. Benning, GA	784-2687	835-2687	404-545-2687
Infantry, School	Ft. Benning, GA	784-4487	835-4487	404-545-4487
Intelligence	Ft. Huachuca, AZ	None	879-3609	602-253-3609
Maintenance and Supply	Tobyhanna Army Depot, PA	None	795-7900	717-894-7900
Missiles and Munitions	Redstone Arsenal, AL	None	746-6627	205-876-6627
Nondestructive Testing	AVSCOM Liaison, Ft. Hood, TX	None	737-6006	817-287-6006
Ordnance (Help Line)	Aberdeen Proving Gnd, MD	None	298-4357	301-278-4357
Quartermaster	Ft. Lee, VA	927-3767	687-3767	804-734-3767
Signal, Electronic Training	Ft. Gordon, GA	240-7777	780-7777	404-791-7777
Signal, Electronic Equipment	Ft. Monmouth, NJ	None	992-3266	201-532-3266
Soldier Support Center	Ft. Benjamin Harrison, IN	542-4962	699-4962	317-542-4962
Supply	New Cumberland Army Depot, PA	None	997-7431	717-782-7431
Supply	R&D Center, Natick, MA	None	256-5341	617-651-5341
Turbine Engines	Corpus Christi Army Depot, TX	None	861-2651	512-939-2651

Army

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Fill out and submit a DA Form 12-5-R and send to the address shown in block 5.

If your unit does not have a publications account number, fill out and submit a DA Form 12-R as well as a DA Form 12-5-R and send to the address shown in block 5 of the latter. For more information see DA Circular 310-84-3.

Distribution changes should be submitted on a DA Form 12-5-R.

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Warrant Officer Selection for the FY 87 Fixed Wing Multiengine Qualification Course

CW3 Robert H. Gratkowski
Professional Development Branch
Warrant Officer Division
U. S. Army Military Personnel Center

Are you an Army Aviation warrant officer contemplating the likelihood of exchanging your hover hole for a taxiway? Does the thought of cruising at flight levels rather than leaf level appeal to your spirit? Do you wonder at the mystic world of retractable gear, reverse thrust and a handful of throttles? If so, and you are concerned as to whether or not you have the qualifications to apply for the Fixed Wing Multiengine Qualification Course (FWMEQC), then take a few minutes with this article. This could be the beginning of your integration into a new realm of excitement.

Naturally, it would be an injustice to give the impression that everyone who desires this course, and is fully qualified, may reasonably expect to attend. There just aren't that many quotas available. As a result, each fiscal year that the course is conducted, a Department of the Army selection board is convened to identify those best qualified for attendance.

The selection board for the fiscal year (FY) 1987 course will convene in June to consider all eligible warrant officers whose applications have been received at the Military Personnel Center (MILPERCEN) by 30 April 1986. It is imperative, should you be considering the application procedure, that the above deadline be met. Applications arriving at MILPERCEN after 30 April will be returned without action.

To determine your eligibility, you must first consider whether or not you are in a career status. That means you must be either Regular Army (RA), or approved for Voluntary or Conditional Voluntary Indefinite (VI or CVI) status. Meet those basic qualifications? Fantastic! Now, let's get a little more involved with specific requirements.

As long as you are on Active Duty in a career status, you may apply if you:

- Possess a rotary wing instrument rating.
- Will not have more than 25 years of total active federal service, if RA, as of 30 September 1986.
- Will not have more than 15 years of total active federal service, if VI or CVI, as of 30 September 1986.
- Have not been previously qualified in an Army fixed wing aircraft.

Sound like a laundry list of musts? There's more! Next you must consider your potential assignment status:

- You must be eligible for a permanent change of station move in conjunction with attendance at the FWMEQC.
- If overseas, you must have a date of estimated return from overseas between October 1986 and September 1987.
- If in the continental United States, you must have served a minimum of 36 months on station as of 1 October 1986.

• Finally, you must be eligible for worldwide assignment upon course completion.

The only exception involved concerns your assignment status. If you are not in the appropriate movement status, you may still apply if your command agrees to fund the temporary duty. Such an agreement will be stated on the forwarding comments at the time of application.

You understand the qualification data, and feel it is worthy of your efforts to submit an application. The process is quite easy and doesn't involve the services of an army of personnel technicians, teams of sorcerers and 2 weeks deciphering mysterious military documents. *All you have to do is submit a DA Form 4187 through channels to: Commander, MILPERCEN, ATTN: DAPC-OPW-AV, 200 Stovall Street, Alexandria, VA 22332-0400.* A very painless operation that can be completed at a doughnut shop after the morning briefing. Just remember to indicate, on the 4187, your preferences for follow-on training in either the OV-1 Mohawk or the U-21 Ute/C-12 Huron aircraft.

The mechanics of the selection process are now your primary concern. As stated, quotas are limited. The FY 1987 class, for instance, will have only 40 quotas. When the limited quotas available are compared against the projected number of applicants, it is apparent that only a small percentage of applicants will be accepted. Still, there will be selectees, and you may be one of them. *Don't* give up on the process without even initiating action!

As each application arrives at MILPERCEN, files are pulled and prepared for the selection board. The selection board considers the same items all other boards study. The applicant's official military personnel file, photograph and Officer Record Brief are the prime concern. Quite important is an applicant's height and weight data, profile data, service componency, civilian and military educational level, and performance data. The board looks at the entire officer.

Once the board is adjourned, those selected will be programed for the course. Dependent upon Army requirements, every effort is made by the career manager to provide graduates of the course with follow-on training in the aircraft of their choice, along with a minimum of a 1-year utilization tour in the field.

There are probably a number of potential applicants reading this article that yet retain some skepticism concerning their chances of selection: senior Army Aviation warrant officers, for instance, who have heard that only CW2s will be selected. Or, CW2s that feel they are too inexperienced in Army Aviation to compete against senior warrant officers. Perhaps, then, it would be appropriate to analyze the distribution of quotas.

Of the 40 quotas available for FY 87, 25 are dedicated strictly to CW2s; 10 are dedicated to CW2 (Ps) and CW3s; the remaining 5 are dedicated to CW3 (Ps) and CW4s.

"There you are!" you say. "You're selling the senior warrants short!"

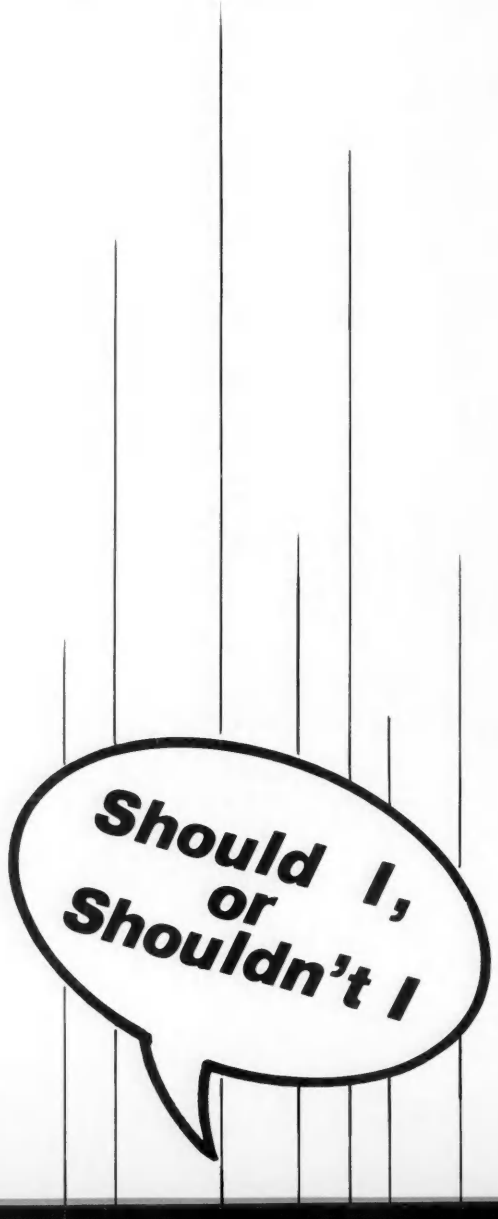
Admittedly, the initial impression is just that. One might even admit that the new emphasis to create a younger base of fixed wing rated Army Aviation warrant officers is indeed penalizing the senior warrants to some extent. There are those who have been told, "You're too inexperienced to be considered. Get some muddy boot time under your belt. Get all of the line unit assignments possible and you will be considered at a later date."

Now, with an eternity of "line unit" assignments under their belts, the senior CW3s and CW4s are being told that they are too experienced. They are also being asked to support comparatively junior warrant officer emphasis in the program. There are reasons, however, for this shift in policy.

Overriding cost constraints and limited position requirements in the field have dictated a rather small percentage of fixed wing, compared to rotary wing, rated aviators. As a result, the program evolved into a perceived reward for exemplary, extended service. Following this perception, the primary selectees through 1983, were senior warrant officers. Furthermore, until 1984, more than half of the selectees for the course were retirement eligible at the time of their selection. Complicating this situation was a fixed wing force established in the field that was also predominantly retirement eligible or approaching retirement eligibility. Not only was the Army faced with a potential loss of its experienced base in rapid order, but also management of the fixed wing strength posture was becoming nearly impossible. Projectable retainability was nonexistent for all practical purposes.

No longer can the Army afford the luxury of maintaining such an approach to this critical program. To establish a new experience base and simultaneously provide for long-range management of this base, the accession of predominantly junior warrant officers is necessary—a bitter pill for senior warrant officers to swallow, certainly, but a pill that cannot be avoided.

The Army shall emerge from the quota realignment with distinct advantages and a fixed wing community offering the highest caliber of technical expertise and professionalism. *Do not give up hope, regardless of your grade. Initiate your DA Form 4187 if you meet the qualifications.* It never hurts to try. Either way, remember that quotas available are quite limited, and nonselection is not derogatory. As with all else, the needs of the Army come first.



WE ALL KNOW that newly assigned aviators must continue their training in order to gain experience, increase their flying proficiency and build their confidence level (not beyond their actual ability) so that they may become mature pilots in command (PIC). I don't mean physically mature, but rather mature in the decisionmaking process.

By human nature, competition exists whereby a new aviator, seeing his or her contemporaries' abilities (both by the book and individual methods), attempts to compete with them; this many times ends in disaster. Who's to blame for this? Maybe nobody, maybe everybody! In our society, competition seems to be a way of life, a keep-up-with-the-Joneses' type attitude. How many of us have raised a brow, or talked among ourselves, about decisions that our coworkers have made concerning a mission? We've heard, "I would not have gone!" Or, "Anybody could have handled that!"

No matter what goes through our minds, we, as PICs, standardization instructor pilots, instructor pilots and commanders must consider this: Each individual has his or her limitations that *must not* be exceeded. Although the aircraft limitations may not be in question, nor may the regulations be violated, the less experienced aviator may not have the ability to contend with the existing circumstances. If we continue to pressure these individuals, they may exceed their limitations to a point that the result could be and probably will be an aircraft mishap—maybe not today or tomorrow, but someday, that pressure will come back. And what about the young aviator striving to become a PIC? If he or she sees this peer pressure happening, will they push themselves beyond their capabilities just so that they are not talked about? Probably yes. Constructive criticism is fine: Sarcasm is not!

***Flightfax* addresses many accidents in which the aviator performs a maneuver that ends in a mishap.**

Five aircraft were to reposition from one landing zone (LZ) to another LZ during a field exercise. Ceiling and visibility were down. One aircraft took off, entered instrument meteorological conditions (IMC), crashed and burned beyond recognition.

Why did this individual attempt this? Was he doing as he was ordered? Did he think he could handle it? Did he want to impress his commander? Or, did he exceed his personal limitations?

Three UH-60 Black Hawks were on a night vision goggles (NVG) navigation training flight. After the lead positions changed, #2 aircraft hit a 150-foot tree and crashed.

Why? **Was the NVG training at too low an altitude for lighting and terrain conditions? Maybe the aviator thought he could handle it, or maybe he exceeded his limitations since the other aircraft crews weren't having any problems. When an aircraft accident results in crewmember fatalities, nobody knows for sure why it happened. One thing though is certain: LIMITATIONS WERE EXCEEDED! If they weren't, there would not have been an accident. The limitation(s) could be the individual limitations, or the aircraft limitations; not necessarily the regulations.**

What about the regulations? They are written as a standard, based on Federal Aviation Regulations in consideration of safety, not on a pilot's personal ability. If, for example, an aviator, based on his experience level, does not require any takeoff minimums into IMC and does not feel comfortable with the existing weather conditions, nobody should pressure him to go. Granted, sometimes aviators have to push their limits but that is their choice—theirs alone. Here is an example:

A pilot and copilot were to transport some passengers in a UH-1H Huey to another installation to review their records. The weather at departure was 30 SCT 50 BKN with 7H. Destination weather was forecast to be 80 BKN and 3F at arrival. Shortly after takeoff, the aircraft entered IMC. So far so good. While the copilot was at the controls, he told the pilot that his attitude indicator was not working properly. The copilot rolled the aircraft into a 30-degree right bank (referencing a cloud deck) and said everything was OK. The pilot, suspecting vertigo, took the controls and regained the proper attitude. From that point on the copilot was somewhat confused. While back in the soup again the crewchief noticed smoke coming from above the pilot's head (under the soundproofing) and told the pilot. The pilot could not get any assistance from the copilot and had to do everything by himself. Not knowing the source of the smoke, the pilot declared an emergency to air traffic control (ATC), which cleared the aircraft to descend to minimum vectoring altitude in hopes that the aircraft could exit the clouds. This did not work so the aircraft climbed back up to minimum reception altitude. ATC then cleared the aircraft to the initial approach fix (IAF) for the approach to be flown. While en route to the IAF, the aircraft lost the signal and was unable to continue. ATC then announced that it would vector the aircraft to final of another approach and reported the weather. Destination was now 1 OVC ⅛ R. The pilot asked the copilot for approach information at which time he received impertinent information. The pilot then had to fly the aircraft, tune the radios, review the approach plate, navigate and talk to ATC. To add to the pressure, there was not sufficient fuel to reach an alternate and the weather was not going to get any better. The aircraft was landed without problem, but the pilot delayed his takeoff for the return trip until visual flight rules conditions existed.

Chances are, the pilot exceeded his personal limits, but he didn't have a choice. It came out later in this situation that the copilot had never been in the clouds before, but he was strongly motivated about going that morning. Why didn't he say anything?

If a coworker's judgment differs from yours, find out why. Maybe he or she is just not comfortable with the options for the day (for whatever reason).

Too many aircraft mishaps are due, and will be due, to "pilot error," in both visual and instrument meteorological conditions. But don't forget, we're the ones that made them PICs.

CW2 Erik P. Feldmanis
Directorate of Plans and Training
Aviation Division
Fort Knox, KY

SPRAINS, STRAINS AND PAIN

Captain Douglas E. Hemler, MC

CPT Hemler is a flight surgeon at USAHC Chun Chon, Camp Page, APO San Francisco. This article was written while he was a student in the U.S. Army Flight Surgeon Course.

IN THE ARMY, the Sunday ritual of beer, hot dogs and softball has been honed to a fine art. Associated with it is a group of fair to moderately conditioned individuals (ever-ready to take the physical training (PT) test, right?) out for some Sunday fun. Given the right conditions, they become a veritable cauldron of sports injuries waiting to happen. After all, who could resist clipping the company commander as he rushes for the goal line—or sliding in and scoring the winning run, while flattening the first sergeant all at the same time.

While it's true that there are some sedate branches within the Army, Aviation is not among them. After a tough week on the flight line, pulling Gs, slinging loads or whatever, the aviator is ready to relax. Since an aviator's idea of relaxation is basically just charging off in another direction, there is a good chance that some athletic pursuit will occur along the way. When Monday comes, there is a reasonable chance that someone on the flight line will be a trifle sore, maybe walking with a bit of a limp.

In most cases, weekend injuries result in nothing more than minor inconveniences. For the aviator they can be potentially hazardous to flight pay, promotions, careers and even

lives. Consider the aviator with a sprained knee or ankle who experiences a low altitude hydraulic failure. Unless he is superman, there is a good chance the pain will get the better of him, with disastrous results.

Sprains and strains are by far the most common and disabling athletic injuries. In spite of misconceptions, these "minor" injuries account for roughly 45 to 90 percent of all injuries and loss of time in professional football, basketball and soccer. They are even more common in amateur athletes. They also have a nasty tendency to show up unexpectedly around the home or job.

Preventing strains and sprains takes the form of staying in good condition (we all do that pretty well) and doing a good warmup (we all do that pretty poorly). After doing those things, we have to be ready in case we suffer a strain or sprain. Since these injuries are not life threatening, there is a tendency not to do anything about them. First aid that is started immediately may save you days or weeks of downtime. It may even save your flight status. First aid is also easy to do.

The most important part of injury care is what you do before the medic or doctor is available. Don't wait until you get home or until you get to the emergency room. Start right away! If you can remember the word "RICE" you can do the first aid. The letters stand for:

Rest
Ice
Compression
Elevation

Rest comes later. On the field, the first step is ice, ice and more ice! Cold has a tremendous impact on the reduction of injury. It works by reducing swelling and the tissue's need for oxygen and nutrition when the body is hurt. It also helps the pain. Real ice works better than chemical packs. Chem-packs wear out quickly and often do not get the cold deep enough into the tissue. Actually, this is great.

The Warmup, Warmdown Cycle
A complete warmup takes time, but it helps you to perform better and protects you from injury.

1. Light stretching
2. Jogging
3. Slow, complete stretching
4. Sport-specific warmup
5. Rest 5 to 10 minutes (psyche-up)
6. Event
7. Warmdown
8. Stretching

You are more likely to have an ice chest full of cans than a bunch of ice packs. Ice in a garbage bag or jumbo baggie works well. Place the pack over the injured site and leave it for 20 or 30 minutes. First it will feel cold, then it will sting, then ache and finally go numb. It may not feel great at first, but numbness is not too bad when you consider the pain it replaces.

Some don'ts about cold. Don't leave the injury in ice all day. Cycles of cold application for 20 to 30 minutes each hour seem to offer the best results. Don't use anything colder than normal ice cubes. Ther are a few stories around about people using dry ice—bad skin burns and frostbite can occur! Plain ice is just fine. Don't use heat in the first 48 hours. It may feel

great, but it has the potential to make the injury worse. Your flight surgeon can tell you when it's OK to start using the warm stuff. Save it for then.

Keeping the injury from swelling with an elastic bandage (also called an Ace Wrap) is what compression is all about. The body tends to overdo it at times like this. Most of the swelling is not necessary and actually slows your ability to heal. For first aid purposes, wet the bandage before using it. This will avoid insulating the skin from the ice pack. Wrap it firmly but not tightly. The idea is to prevent swelling, not movement. Watch the fingers or toes below the wrap for good circulation. If they are turning blue, just loosen the bandage. It should be loosened at least once each hour anyway.

Elevation is also used to prevent swelling. With your buddy on his or her back, place the arm or leg on 6 to 10 inches of padding. The position is comfortable and provides a worthwhile function at the same time. Gravity will help some of the extra fluid to drain back to the normal circulation. Don't try to string an arm or leg 3 feet in the air. Just because a little bit is good doesn't mean a lot is better.

If it hurts bad enough to go through all these steps, it is worth going to the flight surgeon. Even though the pain is often severe in a sprain or strain, the damage is easy to underestimate. Part of the reason is that mild sprains hurt just about as much as severe ones. Pain and swelling will often hide a fracture. Don't hesitate to have your injury evaluated. It may be worse than you think. Not only that, I need a job.

Between the PT test and the current weight control standards, today's soldiers are fitter, healthier and have a better appearance than ever before. With the strict requirements needed to stay on flight status, Army Aviation people are a step above that. Athletics in today's Army is a part of your job and your social life. For the sake of your mission and your own well-being, keep yourself fit enough to meet the level at which you compete. Try to be easier on your commander and the first sergeant and *never* beat up on your flight surgeon. With these words, get out there and knock-em dead, soldier!

Defending Champions

WORLD HELICOPTER CHAMPIONSHIP

Ft. Rucker 1986 Finals

Mr. William Hayes
Public Affairs Office
U.S. Army Aviation Center
Fort Rucker, AL

ARMY AVIATORS from five Army posts will comprise the U.S. Precision Helicopter Team to compete against world-class helicopter pilots in England this summer.

The eight top teams in the U.S. Helicopter Team Trials held at the Army Aviation Center, Ft. Rucker, AL, will face teams from at least five other nations near Castle Ashbey, England, 16 to 20 June. The site is about 60 miles northwest of London.

Winners of the U.S. Team Trials held 10 through 14 February were announced in recent ceremonies. Scoring a final 591 points was enough for CW2 Robert D. Kent and CW2 Patrick H. King II, of Ft. Rucker, to win the Ft. Rucker competition.

With 200 points at stake in each of four events, the eight top slots remained within reach for more than half the competitors up to the final event.

All contestants flew utility or observation helicopters equipped with standard flight and communications instruments. High-tech navigation aids were not permitted in the competition.

Scheduled to begin Monday (10 February), the Timed Arrival and Rescue event was postponed due to low ceilings and limited visibility. Event organizers quickly rescheduled the Precision Hover event for the same day, but that event also was postponed as rain and thundershowers swept the course.

Tuesday remained overcast, but ceilings and visibility were sufficient to run the Timed Arrival and Rescue. Aviators on the starting line received a map with a marked 70-kilometer course only 5 minutes before their staged takeoff times.

Flying the prescribed route at specific airspeeds, the aviators tried to cross an arrival line precisely on time, and penalty points were deducted for each second early or late.

They then flew a 2-minute "box" pattern to approach a rooftop mockup with a small hole on one side. They were next required to lower a weight on a rope and maneuver it into the hole from a hover without the aid of manual adjustments.

Wednesday morning, the aviators were directed to fly to Chipola Municipal Airport near Marianna, FL, for the Navigation event.

Skies were clear, but temperatures in the 30s and gusty winds presented special challenges.

Once again, just 5 minutes before scheduled takeoff, each team received an instruction packet. They were required to fly a course of several straight and curved legs, drop small sandbags into target circles 1 meter wide, spot marker panels along the route, and cross an arrival line near the start point precisely on schedule. Some of the top scorers in the event crossed the line within seconds of their scheduled arrival.

On Thursday, the Precision Hover and Helicopter Slalom events were conducted back-to-back in an all-day doubleheader session.

USPHI Team Trial Finals

Place	Points	Crew	Home Station	Aircraft
1	591	CW2 Raymond D. Kent CW2 Patrick H. King II	Ft. Rucker	OH-58
2	527	CW3 James A. Maddox CW2 Howard H. Fancher	Ft. Rucker	OH-58
3	511	CW2 Jimmy A. Green CW2 Jon A. Iseminger	Ft. Rucker	OH-58
4	510	CW3 Don E. Jewkes CW2 Gary R. Reed	Ft. Carson	OH-58
5	507	CW3 James R. Church WO1 Hal G. Harless	Ft. Campbell	OH-58
6	462	CW2 George W. Egbert CW2 Paul W. Hendricks	TXARNG, Austin	OH-58
7	448	CW4 John Loftice CW2 Kenneth Wright	Ft. Bragg	OH-58
8	446	CW2 Noel C. Seale CW2 Michael C. Pascalar	Ft. Rucker	OH-58
9	413	CW3 James E. Smith WO1 Thomas R. Schafer	Ft. Rucker	OH-58
10	384	CW3 Donald G. Andera CW3 Michael D. Spradling	Ft. Rucker	UH-1
11	374	WO1 Steven G. Gray CW2 John P. Law	Ft. Campbell	OH-58
12	354	CW2 Thomas P. Reynard Mr. David Clark	Ft. Rucker	UH-1
13	320	CW4 Ron Carlson CW3 Wayne L. Spell	Ft. Belvoir	UH-1
14	314	CW2 Roger H. Brown WO1 Jonathan Rider	Ft. Benning	UH-1
15	311	CW2 Robert G. Mota 1LT Wayne Sass	Ft. Sill	OH-58
16	306	CW4 James E. Jackson CW3 Howard C. Arnold	USREDCOM, McDill AFB	UH-1
17	298	CW3 Thomas C. Schultz CPT Michael L. Powell	Ft. Greely	UH-1
18	284	1LT John A. Perkins WO1 Albert J. Maes Jr.	Ft. Bragg	OH-58
19	270	CW2 Jamie L. Martin WO1 Dennis W. McKinney	Ft. Hood	OH-58
20	267	CW2 Boyce J. Bingham CW2 Lowell Neese	Ft. Colby, Panama	UH-1
21	234	CW2 Robert A. Ward CW3 John M. Fore	Ft. Polk	OH-58
22	231	CW3 Steven R. Sator CW2 William R. Tompkins	Ft. Rucker	UH-1
23	166	CW2 Nigel K. Sapp CW2 Charles d. Beard	Ft. Polk	UH-1
23	166	CW3 Colin S. Hudson CW2 Randy E. Hann	Ft. Hood	UH-1
24	139	1LT Thomas W. Charron CW2 Maurice A. Pinkney	Ft. Hood	UH-1
25	109	Mr. Michael Hynes Mr. John Price	Hynes Aviation Frederic, OK	Hynes H2
26	47	Mr. Patrick Hynes Mr. Mark Latimer	Hynes Aviation Frederic, OK	Hynes H2

For the hover competition, each aircraft was fitted with weighted ropes of different lengths. Each hovered forward, backward, sideways and obliquely around a square course. All the while, they tried to keep a reference point on the aircraft within a 1-meter lane and maintain a hover altitude within a 1-meter bracket. Penalty points also were deducted for elapsed time.

The Slalom event involved a winding course through a 200- by 100-meter course with a bucket of water suspended below the aircraft. The aviators had to negotiate 12 "gates," then set the bucket on a small table at the end of the course. Points were deducted for missing gates, the bucket's distance from the center of the table, water spilled, and elapsed time.

Listed above is a summary of the final standings by the 27 competing teams.

See the February 1986 *Aviation Digest*, page 18 for coverage of the first round of the 1986 World Helicopter Championship. For coverage of the 1981 World Championship, see *Aviation Digests*, April 1981, page 49, "U.S. Army Helicopter Team"; September 1981, page 22, "World Helicopter Championship, the World's Best"; and January 1982, page 2, "World Helicopter Champions," by Major Bronislaw R. Maca.

Plane Crashed 19 Years Ago

Sergeant First Class H. C. Willard
Public Affairs Office, 193 Infantry Brigade, APO Miami

SEVERAL MEMBERS of the 114th Combat Support Aviation Company, 210th Combat Aviation Battalion, were called upon to assist in the recovery of the remains of four men who were killed in a plane crash 19 years ago in Costa Rica.

The Cessna 180 aircraft and its occupants disappeared while en route from San Jose to Limon, Costa Rica, in April 1966.

An Indian hunter discovered the wreckage of the plane that was in a small stream in the mountains about 60 miles east of San Jose.

A Costa Rican Red Cross worker erects a cross at the site where four persons died in 1966.

"The American Embassy received a request from the chief of Costa Rican Internal Security to assist in the recovery, since a helicopter would be needed to reach the crash site and the UH-60 Black Hawks would be training in Costa Rica," said Dr. Edgar Jimenez, a doctor employed at the American Embassy in San Jose. "The recovery operations were part of the humanitarian assistance projects," he said.

"The hunter who discovered the wreckage must have been standing on it before he saw it," said Lieutenant Colonel John Taylor, Office of Defense Cooperation. "Only about 1 square foot of the white and red trimmed plane was showing because of the overgrowth and mud," he said.

Several members of the Costa Rican Red Cross were inserted by a Black Hawk as close as possible to the crash site and trekked by foot to the remote crash site, where trees had to be cut down and a helipad improvised amid mud, rocks and stumps so the Black Hawks could land.

"The Black Hawks and their crews have proved to be invaluable in the humanitarian assistance efforts since their arrival in Costa Rica," said Dr. Jimenez. "Without them, the recovery of the remains would have been extremely difficult, as there are no roads anywhere nearby.

photos by SFC H. C. Willard

Red Cross workers and a television crew get a briefing from Dr. Edgar Jimenez (center) as a Black Hawk sits in a hastily made landing site.

"As the situation is, it's been 10 days from the time of the discovery of the crash until the recovery of the remains," he said.

According to Dr. Jimenez, the remains of the victims were taken to a forensic laboratory for positive identification and to be turned over to their families.

The Black Hawk crewmembers who assisted in the recovery of the victims' remains were CPT Rudolph R. Cohen, 1LT Edmond Moore, CW4 Harry E. Neuling, CPT Guillermo Cabeza, CW3 Timothy Kaminski, CW2 David Barker, CW2 Edward Encinas, CW2 Donald Coster, SFC Juan Fuentes, SP4 Eddy Owsley, SP4 Glenn Greene, SP4 Gregory Taylor and PV2 Gerald Ballard.

VETERAN ARMY FLIGHT SURGEON RETIRES

For his service as flight surgeon for Company D, 38th Aviation Battalion, Missouri Army National Guard, Warrensburg, MO, Colonel E. A. Munyan, M.D. (left), accepts a Distinguished Service Medal. Major Michael Schuster (right), commander of the attack helicopter gunship company, presents the medal during official retirement ceremonies held at the Warrensburg Armory.

ARMY NATIONAL Guard veterans of World War II are moving more and more from drilling to retired status. A Missouri Army National Guard flight surgeon is one of the most recent to join the retired rolls. He is Colonel E. A. Munyan, M.D., Overland Park, KS, a flight surgeon for Company D, 38th Aviation Battalion, Warrensburg, MO. He was a student at Princeton University at the onset of World War II, when he enlisted in the Army.

Trained as a medic, Colonel Munyan served at a prisoner-of-war camp in France. He also saw combat as a rifleman, being awarded two battle stars plus a Combat Infantry Badge. After the war he returned to Princeton University to complete his degree.

In 1951, Colonel Munyan was graduated from Cornell University Medical School, and took a residency at Charity Hospital in New Orleans, LA, where he also joined the U. S. Naval Reserve. He saw duty on three aircraft carriers, a destroyer and several submarines as a medical officer. As an M.D. he practiced in Louisiana and New York before moving to Independence, MO (where he maintains his medical practice) and joined the Missouri Army National Guard.

Colonel Munyan said the item which he has enjoyed the most about being a member of the Missouri Army National Guard has been the camaraderie. "I've been flying since I was 15 years old and have very much enjoyed being in an Army Aviation unit," the flight surgeon said.

With more than 30 years of Active and Reserve military service, Colonel Munyan, now 64 years of age, said he was reluctant to retire but noted, "It's time." He plans to keep his medical practice in Independence and to pursue his flying hobby and love for gardening.

Colonel Munyan said he had served as a flight surgeon during the assignments of six commanding officers of Company D over the years. "Thanks to their dedication, plus that of every member," observed Colonel Munyan, "this is an attack helicopter gunship unit that is ready to go on Active duty at a moment's notice."

The ***Aviation Digest*** thanks Captain Daniel B. Miles Jr., press officer, 70th Public Affairs Detachment, Missouri Army National Guard, Jefferson City, MO, for sending this item about Colonel Munyan's retirement.

Let's Make A Deal

Working closely with other activities to test aviation equipment for performance, reliability and maintainability in the field is the primary responsibility of the United States Army Aviation Board. Whether testing materiel or training to ensure a product's efficiency, safety of personnel is the main concern. Toward that end, as users or operators, we solicit your assistance in this endeavor.

photo by Piper

Colonel Stanley E. Grett

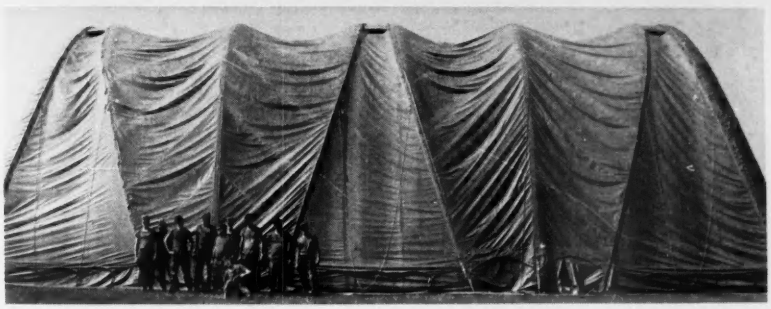
Colonel Grett, president and commander of the United States Army Aviation Board, is a dual-rated, Master Army Aviator and a graduate of the University of Nebraska. In addition, he has completed training with industry and is a graduate of both the Command and General Staff College and the U. S. Air War College. Among the numerous offices he has held are those of project officer, Directorate of Combat Developments; assistant program manager, Advanced Attack Helicopter PMO; and Army Aviation safety officer in the Office of the Deputy Chief of Staff for Personnel in the Pentagon. Colonel Grett assumed command of the Aviation Board on 24 June 1985.

MAN, SCIENTISTS inform us, represents the highest order of the animal kingdom. As such, he has been crowned with the title Homo sapiens and endowed with special attributes that distinguish him from the lower vertebrates. But despite his enviable position—despite his intellect, ingenuity and ability—man remains an imperfect creature.

All too often he is subject to error. He falls short of perfection when he designs something, when he manufactures it, and finally, when he operates and maintains it. We attempt to sanitize his failures by referring to them as deficiencies inadvertently promulgated by imprudent deviation of affected personnel from a code of behavior, but the more apt term is human error.

It was human error that allowed inadequacies to creep in during the design phases of the cabin structure of one commercial airliner and the wing structure of another. Catastrophic failures resulted until causes were identified and cures implemented. Fortunately, such failures are a rarity. Serious shortcomings related to the design and manufacture of aircraft and related components are usually identified and eliminated long before they can produce mishaps.

But we don't have to go to the commercial sector to see human error in action. It abounds everywhere, in-



The ability of the air-inflatable, transportable maintenance shelter—assembled from modules (top)—to provide adequate ventilation, effectively discharge toxic fumes and permit rapid evacuation of personnel in case of fire was an important prerequisite during operational testing.

cluding our own back yard. Nearly 20 years ago, the United States Army Safety Center, then the United States Army Board for Aviation Accident Research (USABAAR), published a handbook for aircraft designers that dealt with specific design inadequacies found in Army aircraft. Following are a few examples:

- The rear seat shoulder harness installation in one type of fixed wing aircraft was ineffective in accidents where impact severity forced the wings downward and forward, because the shoulder harness routing point moved forward with the wings.
- The design of the oil filler cap for one type of aircraft required a safety pin installation to prevent loss of the cap in flight. Several major accidents and some forced landings resulted from broken or missing pins. In these instances, caps came off and engine oil was siphoned overboard. A spring loaded lock type oil cap or the use of a one-way flow valve in the filler neck would have prevented this problem.
- Another inadequacy concerned the fuel selector of a fixed wing aircraft. To get fuel from the right tank, the selector had to be turned to the left, and vice versa. In addition, fuel selector positions were labeled MAIN and AUXILIARY, yet both tanks were identical. Accidents from fuel mismanagement were the result. Curiously, the design of the fuel selector installed on another type of Army aircraft subsequently developed was similar to this one.
- The landing gear control lever of another Army aircraft was originally manufactured from an aluminum alloy material. Three failures occurred before the levers were replaced with steel ones.
- A twin engine aircraft was designed with the propeller control levers positioned to the left of the throttle controls. When a subsequent model was introduced, the propeller control levers were located to the right of the throttles. Needless to say, pilots who flew both models were subjected to inadvertent operation of throttle and propeller control levers.

Efforts of USABAAR and the Human Factors Laboratory brought safety and human factors engineers into the picture early—during the design stages of new aircraft and related equipment. The term "human engineering" soon became a household word. New equipment was expected not only to perform as intended but also to be reliable, readily maintainable in the field and a noncontributor to human error. But even after the various phases of research, engineering, product design, manufacturing and a variety of tests have been completed, "the proof of the pudding remains in the eating," and

that, of course, means operational testing—the prime function of the United States Army Aviation Board.

Formally activated by the United States Army Training and Docrine Command (TRADOC) on 1 July 1976, and assigned to the United States Army Aviation Center, Ft. Rucker, AL, the Aviation Board is currently one of nine separate TRADOC operational testing activities. Although it participates in development tests and performs other types of evaluations, its primary task is to conduct or actively participate in a variety of operational and other user tests of aviation materiel. And while Aviation Board personnel are based at Cairns Army Airfield, they may be found performing tests in Alaska, Germany, England and other parts of the world.

Not An Entity

Nevertheless, despite its staff of engineers, statisticians, methodologists, computer specialists and other highly skilled technicians, both military and civilian, the Aviation Board does not, and cannot, function alone.

Colocated with the U. S. Army Aviation Development Test Activity, the Aviation Board maintains a close relationship with developers for concept evaluation of new ideas that may lead to materiel requirements. And as part of the Aviation Center, it has access to the U. S. Army Safety Center as well as to members of the Aviation Center team. These include the U. S. Army Aeromedical Research Laboratory, Directorate of Combat Developments, Directorate of Training and Doctrine, Department of Combined Arms Tactics, Directorate of Plans and Training, the TRADOC Systems Managers, and the Directorate of Evaluation and Standardization as well as the Army Research Institute and Human Engineering Laboratory personnel at Ft. Rucker.

But even these are not enough. Despite their vast array of resources and talent, no testing could be performed without the support of player personnel and without essential equipment. These are not furnished by the Aviation Board nor by any of the numerous activities listed. They are supplied by units in the field. In many instances the support needed severely taxes the unit commanders who must provide it. Yet, despite their depleted resources in manpower and equipment, these individuals must still accomplish their respective missions. Considering that some tests take months to complete, the strain on commanders who provide the resources can be tremendous.

Finally, it requires dollars to perform the tests. Depending on its nature, the costs of any given test can vary from a few thousand dollars to several million.

By now, it should be clear that testing is not something that is accomplished by a few people from a single testing activity. Nor is it a quick and simple operation. It involves coordination with other agencies, cooperation and support. It takes time, and it costs money.

Safety—An Important Element

However, the important consideration lies in the purpose of testing. While the information required varies from test to test, the purpose of all testing is to make certain that you, the individual, receive the best possible product available—whether equipment or training—to enable you to perform your job efficiently and effectively.

But the benefits that come from testing don't end there. Often overlooked is a most important byproduct that results directly or indirectly from virtually all types of testing. And that byproduct is safety—your safety.

Nearly a half a century ago, for example, when the sulfa drug was being developed, laboratory tests showed it to be effective in destroying a variety of bacteria. To determine the extent of its effectiveness, researchers treated horses suffering from pneumonia with this newly developed drug. Sure enough, as the laboratory tests had indicated, the drug rapidly destroyed the pneumococcus bacillus. There was only one drawback. In the process of killing the bacteria, the drug also killed the horses. Obviously, considerably more research and testing had to be done before the drug could be proved to be not only effective but also safe.

Similarly, of what value is an air-to-ground missile that can seek out an enemy tank from extreme distances and with pinpoint accuracy literally obliterate it, if in the process, it also destroys the aircraft that launched it? Granted, this is an extreme example, but it is not as extreme as you may suppose.

A portion of a test recently completed by the Aviation Board was to ascertain the ability of a helicopter to fire armor piercing ballistic ammunition from various flight attitudes without compromising the integrity of the aircraft and the safety of its crew. Testing, then, is necessary not only to ensure the performance, reliability and maintainability of the equipment being tested but also to enhance the safety of personnel. Unfortunately, testing does not always ensure the safety of personnel who must operate and maintain the equipment in question. And frequently the fault lies with the personnel themselves.

Defeating The System

It seems illogical to spend thousands, or millions of dollars performing tests that employ all types of professional and technical specialists and a host of support personnel over a period of months—and sometimes years—only to have their combined efforts negated in the areas of safety by the very individuals the tests were intended to assist and protect. Yet, this is precisely what all too often is taking place.

Included in the testing of this TH-55A to ascertain the feasibility of using liquid methane as a fuel was the identification of possible hazards liquid methane might pose to personnel and equipment during fuel venting, fueling and defueling operations, and during a crash sequence.

A well-publicized incident serves as an effective illustration. It began when the main rotor of a UH-1 Huey separted from the aircraft during flight with catastrophic results. Examination revealed that a trunnion had separated from the outer swashplate. The cause, however, was not associated with any inadequacies relevant to design, metallurgy or manufacturing procedures. Investigation determined that the trunnion mount failed because of improper maintenance that produced physical damage and overstressed the trunnion mount. Over a period of time, it failed without warning.

What makes this mishap of particular interest is that it was not an isolated case. That similar in-flight failures involving other UH-1 aircraft did not occur could be termed a miracle. During a one-time inspection of UH-1 trunnion mounts, the findings produced were highly significant. Common discrepancies noted included the use of screwdrivers or other unauthorized tools to spread trunnion housing ears during removal and installation of trunnions; failure to properly align trunnion slots with bolt holes; and, forcing retaining bolts into place by pounding them with a hammer or twisting them with a wrench when bolt holes and trunnion slots were improperly aligned. As a result, trunnion housings were found to be overstressed and permanently distorted, and housing ears as well as bolt threads and shanks were severely damaged.

Yet, these maintenance deficiencies were not the result of any willful intent on anyone's part to induce incipient failure and endanger the lives of aircrews. They occurred because of inadequate knowledge and understanding of the critical aspects of these components and the absolute necessity for by-the-book maintenance. This fact was exemplified when mechanics performing the one-time inspection were found to be using the same unorthodox procedures described. In fact, while performing the one-time inspection, one mechanic broke a section of a trunnion housing when he pried the ears apart with a screwdriver.

That the human element is prone to inadvertent error is not new. Even when he exercises ingenuity, man often fails. During the Vietnam War, for example, when a weight and balance problem involving the UH-1 surfaced, Yankee ingenuity was quick to come to the rescue. Because of unique aircraft load configurations, the center of gravity (CG) was found to shift excessively forward, exceeding the forward CG limit of the aircraft. The solution appeared to be a simple one: Determine the ballast and the arm necessary to reposition the CG of the aircraft within the specified forward limit and attach the proper weight to the tailboom at the predetermined location. With the computations completed, holes were drilled at the selected station and the ballast securely bolted in place. Another problem had been solved.

Under the hood in the aft cockpit of an AH-1 (right), the pilot must rely on the video image transmitted to the miniature receiver attached to his helmet (left) for visual contact with the outside world. An assessment of the program of instruction to be used to train pilots to fly by use of this system was performed to ensure safety as well as pilot proficiency.

But success was to be short-lived. As witnesses on the ground gazed at a flight of Hueys returning from a mission, they suddenly noted something appear to fall from one of the aircraft. Almost simultaneously, the aircraft in question nosed over and began to tumble, shedding its main rotor in the process. In a matter of seconds, it was all over.

Investigation revealed the tailboom separated from the aircraft because of stress fatigue. The cause was unauthorized modification of the aircraft. Unfortunately, before the cause was determined and corrective measures implemented, additional accidents of a similar nature occurred.

Good intentions, no matter how noble, can, in short order, negate the best efforts of all the researchers, designers, manufacturers and test personnel when the human element deviates from established procedures. All too often, such deviation results in mishaps.

The Deciding Factor

The point is clear. No matter how thoroughly a product is tested and its reliability firmly established, its performance in the field and the safety of its operators and support personnel depend on you. Your knowledge of the equipment—how it operates and how it must be maintained; your strict adherence to by-the-book procedures in its care and operation; and your observance of applicable regulations are essential prerequisites that must be met. Inadvertent error is just as unforgiving as intentional error. So, don't compromise all the research, development and testing associated with the production of a product by some unauthorized action or omission.

Each of us, from the manufacturer on down, represents a vital link in the Army's chain of operations. Suspended from this chain is an all-important load—successful mission accomplishment. And that includes safety. It is our responsibility, individually and collectively, to make certain every link remains strong and intact so that the chain does not suddenly snap and topple its load. And meeting our responsibilities is not a difficult task. All it entails is the proper performance of our individual jobs.

As president and commander of the United States Army Aviation Board, I give you my assurance that we will do our part. We ask that you do yours!

the Naysayer

Your Untapped Motherlode

Here is a vignette that is a by-product of a particularly frustrating coordinating exercise that finally ended well.

Mr. David G. Holmes

The *NAYSAYER* is the most under appreciated, under used and avoided person in one's working repertoire. This is exactly opposite to the way it should be.

When there is a project to be accomplished in conjunction with other people there should be *naysayers*. They are the people who are going to think of all the reasons why a project shouldn't be done. There will be good reasons, bad reasons, emotional reasons and purely speculative reasons. The *naysayers* will contribute to their fullest. They will articulate without reservation. If they are knowledgeable on the subject whereof they speak the *naysayers* will be particularly valuable.

The initial and almost universal reaction to a *naysayer* is anger and adversarial (you would really like to ring the slob's neck, *slowly*). This is nongoal producing. *Plan* for this "evaluation" of the subject or project by the *naysayer*.

There are definite ways to mine this *naysayer* motherlode:

First, convince yourself of the value of having someone point out all the faults and reasons not to do the project before the project gets to the boss (and the earlier, the better). It's awfully embarrassing and discouraging to be thinking "why didn't I think of that?" as your project gets placed back on the bottom of the boss's calendar and you get credit for shoddy work.

Second, make sure your *naysayer's* input is in a completely neutral forum. If you or the *naysayer* feel a subordinate relationship to the other, the exchange of information will not be totally candid. The way to tell if *naysayers* feel on equal footing is when their remarks begin with, "This is a bunch of BS." You can assume that you are getting their unrestrained opinions from the start.

Third, make sure you do not hinder the *naysayers'* inputs. The *naysayers* have feelings and will be turned off or at least turned down by any verbal or nonverbal responses that you express while they are in the sending mode. Again I emphasize, do not pass judgment or react negatively to the free input you are receiving.

Fourth, reinforce the open communication channel by telling *naysayers* they have certainly pointed out some valuable aspects that you had not thought of, or they have presented the matter in a valuable, new perspective.

Fifth, make a note (mental or otherwise-written is best because emotions run high and good points will be forgotten) of all faults the *naysayers* point out. Some of the faults may be fatal to your project if they are not addressed in the development of the project. Other faults may be purely emotional reactions generated by the traffic jam on the way to work.

Sixth, sort the faults the *naysayers* have pointed out into three groups.

- The first group of deficiencies is those that can be eliminated by simply gathering all the facts and making sure the presentation of the project is based on the facts.
- The second group of deficiencies is those that generate emotional responses. An emotional persuasion must be prepared for use in case these facets of the projects are addressed by the decisionmaker.
- The third group of objections is advanced by the *naysayers* who are purely venting their spleen and must as surely be separated and discarded from their valuable input as is bile—there is no reason to take up your time with these.

When all this is done the project will be prepared for presentation in its best posture to the most adverse reception. You can be confident of having eliminated the weaknesses or at least you are prepared to address the weaknesses and spend the minimum time on the irrelevant.

Identify the *naysayers* as early as possible in the divisions with which you have to work. The *naysayers* will be easy to identify because they are against all new ideas that they didn't think of. Ensure that they express their opinions to you before the decisionmaker sees the project or hears the *naysayers*. When the *naysayers* (or you) move on, replace them as soon as possible with other *naysayers*. The smoother sailing for your project will be due to the *naysayers*, heretofore unsung heroes.

The foregoing rhetoric notwithstanding, my reaction to the *NAYSAYER* is still murder in the first degree.

ABOUT THE AUTHOR

The author has been the civilian aviation safety specialist at Forces Command for the last 3 years after spending 11 years with the U. S. Army Safety Center. He is a rated Army and Navy aviator, and also a member of the Alabama Bar; MSSM from USC.

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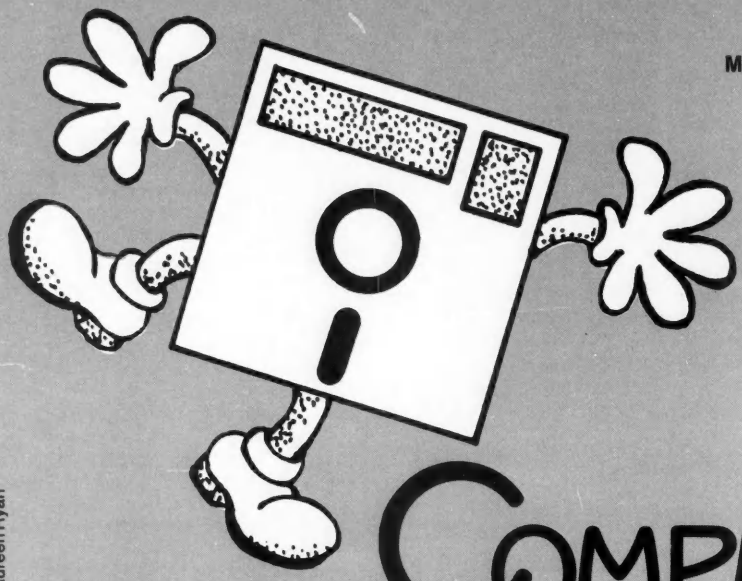


illustrations by Maureen Ryan

COMPUTER SOFTWARE and Army Aviation

The age of the computers is here! The computer has infiltrated virtually every aspect of our lives as Americans, from home video games to microwave landing systems. The Army too is expanding its technology through more use of computers in the cockpit and is developing computer software for the AHIP, which is presently the largest software development program in Army Aviation.

IF YOU ARE among those countless Americans, like me, who were caught up in the computer wave of the last few years, you have probably experienced the shock of discovering that the cost of the computer itself is nothing compared to the stuff that makes it work. It's the software, that amorphous thing that tells the computer what to do, that is the real and mostly hidden cost of owning a computer.

So how does that affect Army Aviation? In the future it will a great deal.

Why Software In Army Aviation?

Army Aviation is beginning to enter the computer age in full stride. Even our most modern fielded aircraft, such as the UH-60 Black Hawk and the AH-1S Cobra, contain relatively few computer processors. The Doppler navigation system, one or two of the newer communication radios and the Command Instrument System contain computer processors and the software to run them, but that's about it. Our aircraft are still far from being computer and software dependent; but that is about to change.

Software And The Apache

Computers and Army Aviation are about to consummate a relationship that will forever change the way Army aircraft are designed, built and flown. The fielding of the AH-64 Apache attack helicopter will give the Army an aircraft with no fewer than 16 computer processors that have been programed in almost as many different computer languages.

Anticipated fielding of the Advanced Helicopter Improvement Program (AHIP—OH-58D) will mark another major increase in the use of computers in the Army cockpit. Computer program development efforts for the AHIP are, to date, the largest software development program in Army Aviation.

The use of computers in the cockpit is leading us to the day when your copilot will be a computer. Actually that day is not far off!

What Exactly Is Software?

Computers and their role in our society have been the favorite subject of numerous periodicals and television documentaries during the past decade. The computer was even named "man-of-the-year" by *Time* magazine. We have pretty well adapted to using computers even if we claim to be computer ignorant. Each time you make a phone call, go through a grocery checkout line or balance your checkbook with a hand calculator you are using a computer. The real mystery of the computer world is not so much the hardware, which you can readily see and hold, but the software, which sits in that thing somewhere and actually does the real work.

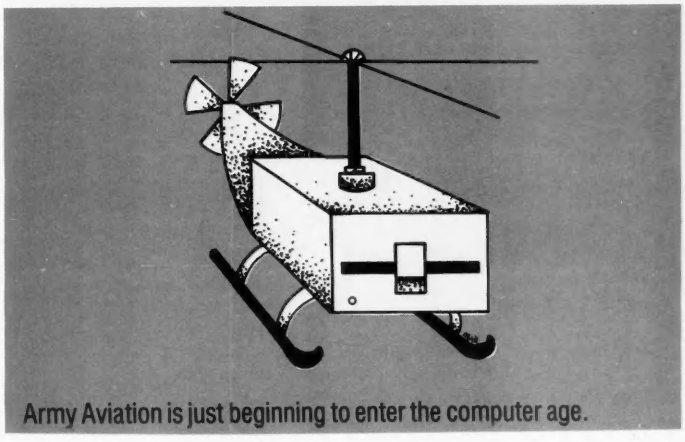
Software is nothing more than the instructions which tell the computer what to do. That seems simple enough, but it gets a bit more complicated when you begin to talk about how those instructions are actually developed and what that means to Army Aviation.

One of the reasons that software is important to the aviator is because it introduces something else that can fail in your aircraft. In addition to a hardware failure, the aviator of future aircraft also must be cognizant of software failures, *and* be able to tell the difference. A purist will argue with the use of the word "failure," because software doesn't really fail or wear out like a mechanical system. What really happens is that it fails to work like it is supposed to because of a latent and undetected error. Whatever the terminology used, if something doesn't work the way it is supposed to, I call it a failure.

All of that does not imply that software necessarily means greater risk in aviation. With the reliability of electronics and computer hardware increasing yearly, the additional risk of software defects is rather small but nevertheless it exists. Fortunately the risk of software failure is more than offset by the increasing dependability of the hardware.

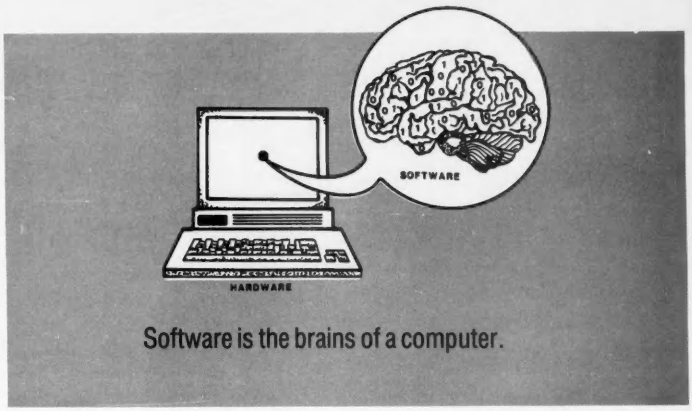
Where Is The Software In The Cockpit?

One of the problems in trying to comprehend software is that it is something of an intangible. It's not something you can readily see and feel. The software inside today's cockpits can be found in memory chips located inside of the individual black boxes that comprise the specific system. In Army aircraft these include navigation systems, such as the Doppler, or the UH-60's Automatic Flight Control System.



Army Aviation is just beginning to enter the computer age.

The memory chips are preprogramed and can only be accessed for information and not permanently changed by the pilot. Most of today's cockpit software is generally comprised of relatively short programs. But, projections of what the Army's newest aircraft, the Light Helicopter Family (LHX), will look like indicate that its software will be substantially increased.



Software is the brains of a computer.

How Important Is Software In Aviation?

The Air Force recently flew its newest research aircraft, the X-29. Anyone seeing it for the first time can't fail to notice that it looks like the wings were put on backwards. The forward swept wing concept is being evaluated for its potential to increase aircraft maneuverability. What is also a bit different is that this aircraft cannot be flown manually through standard push-pull tubes. It is so unstable that it requires control surface adjustments no less than 40 times a second. Only a computer can handle that task and, therefore, the X-29 is completely computer dependent. In fact, the engineers that designed the aircraft estimate it would take about ⅕ of a second for the aircraft to break itself apart if it suffered a total computer failure. What makes those computers work? The software, of course!

The Army does not have any program to build a production aircraft which is totally computer dependent. The "get-me-home" requirement if everything else fails may guide Army Aviation for a long time. It is becoming clear, however, that increased performance in aircraft can be obtained by the use of computers. We'll see a significant increase in the use of computers in rotary wing aircraft, and it's possible they also will be totally dependent on a computer for stable flight.

Why Software Testing Is Impossible

The reason software errors still show up in programs that have been around for years is because large software programs are almost impossible to test completely. That partially applies to hardware as well. You can't test all aircraft on an assembly line to complete failure. You have to begin fielding sometime, after which other hardware problems are bound to surface as the result of daily operations.

Software is not like materiel failure because software simply does not wear out. However, large software programs, sometimes running into hundreds of thousands of lines of computer code, are so complex that there are millions of different ways in which the program can be run.

Software takes different paths depending on what you want your system to do. Although testing can verify millions of ways in which it will work right, there may be a few ways in which it won't. Only time may find those ways, usually of course, during the *most inopportune* situations.

Extremely large programs, which are becoming more common all the time, have so many possible deviations that even if a likely route were tested every microsecond it would still take hundreds of years to test them all. For that reason it is physically impossible to do a 100 percent test on a software program of any significant size.

What this really means is that software testing never really stops and the organization responsible for maintaining the software program continues to test the program for the life of the system. Future software development programs may find ways to write programs using software modules. If the modules can be tested completely then it is possible to develop programs which are much more reliable and closely approach 100 percent testing.

Software Bugs

One of the most recognizable terms in computer jargon is the software "bug." The term is part of the legacy of Commodore Grace Hopper, the oldest Active Duty member of the Navy. Commodore Hopper belonged to a very august group involved in programing the earliest computers shortly after World War II. Although she is credited with numerous achievements and is still a very active member of the U.S. Navy, it was her discovery of a moth for which she will perhaps be best remembered.

After one of the many breakdowns of the early vacuum tube computers on which she pioneered, she discovered the problem to be a wayward moth in the circuitry. Henceforth this became known as a computer bug and means something which is fouling up your computer.

One of the better known tales of a software bug, that proved catastrophic, belongs to the Mariner space program. After one particular launch, the vehicle simply continued to fly into deep space and failed to respond to course adjustments. The computer program was closely scrutinized, and a period was discovered

where there should have been a comma. The incident parallels the verse "for want of a shoe . . . the kingdom was lost."

Computers are also prone to simple human error as was unfortunately demonstrated during the British experience in the Falklands. The British lost one of their more modern ships to a French Exocet missile launched by the Argentinians. The story goes that the British had not changed the software of their extremely capable antimissile defense system to recognize the Exocet as an enemy missile. The program supposedly identified the Exocet as a friendly missile, with disasterous results.

Changing the Program

Aircraft in the field today, and including those just being fielded, have software onboard that is relatively inflexible. Aviators do not physically program their aircraft for each mission. Each system carries its own software routine, usually in something called Read Only Memory or ROM.

Future aircraft, however, will have numerous electronic systems to include map and mission displays. At some point it will be necessary for aviators to be able to input mission data, much like aviators of today enter navigational data into a Doppler navigation system. The problem is that a few items entered into a Doppler system is one thing, but an entire mission planning sequence, to include map overlays and enemy data, would take much too long to key in while you are sitting on the ground. There has to be a way to program the aircraft quickly as part of the mission planning/starting procedures.

The solution to the cockpit programing requirement is being researched now. Future unit operations centers will include computerized planning stations where aviators will conduct mission planning. These stations will then program the necessary information into a module, perhaps like a cassette or some other device, which aviators will simply "plug" into the cockpit.

Timesharing In The Cockpit

Future aircraft, especially the LHX, will be much more electronically sophisticated and reliant on their onboard computers. In fact, a major change in the way computers are used in the cockpit will occur with the fielding of the AHIP. Today all systems that make use of a computer processor are essentially stand-alone systems. They are not physically interconnected.

Tomorrow's Army aircraft will make use of a central computer processor that all of the onboard systems will share. This is something like the timeshare system that a lot of schools and businesses have now. There is a central computer somewhere in the building, and all of the users are on terminals in their offices. Within the cockpit something similar also will be true. Each system, such as communication, navigation, etc., will share a central processor, and its backups, through a standard data bus. The latter is nothing more than a pair of wires with yet another computer to control the information flow on those wires.

Highspeed Computers

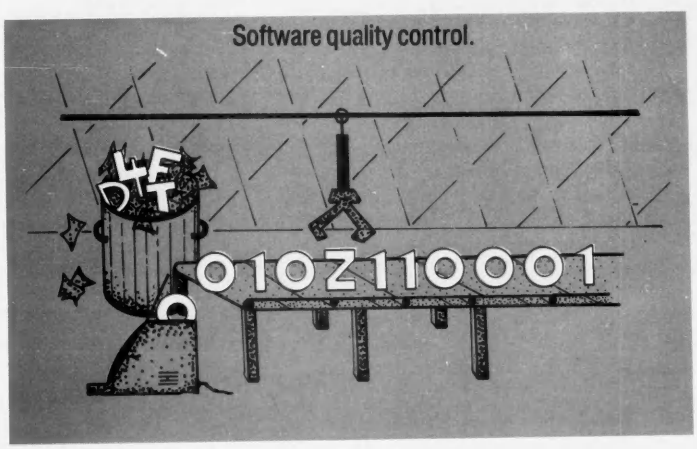
Timesharing computers in the cockpit is a scary prospect to anyone who has ever had to timeshare in an office or at school. Those of you so blessed can probably remember waiting, sometimes for long periods of time, for the terminal to catch up. That is particularly irritating when you are typing information and the terminal is several characters behind.

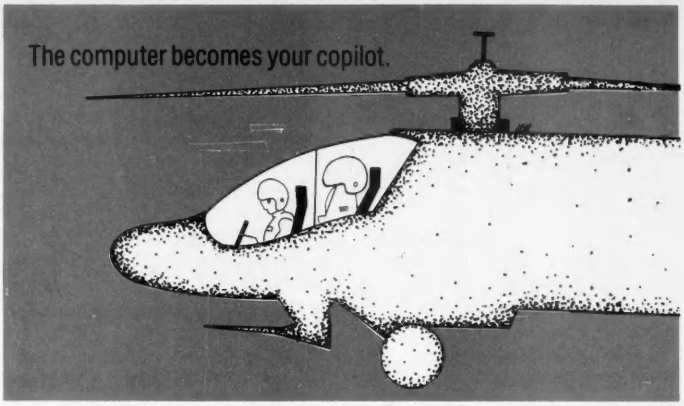
Within the cockpit a significant time delay is obviously not acceptable. Although there will be a priority system established, since flight control information is more important than radio tuning, time delays due to a heavy computer load will be measured in microseconds and not in the minutes you get on a user terminal.

A few years ago the Department of Defense (DOD) launched a large technology program to design, build and produce an extremely fast and efficient computer processor. These chips are known as VHSIC chips, or Very High Speed Integrated Circuits. These chips are projected for use in many DOD programs including future Army aircraft.

Computers may seem fast when you are balancing your checkbook or working on a dedicated word processor. However, the speeds at which they must be able to operate in a fully modernized, fully electronic cockpit will actually push the speed of light.

Hard as it may be to conceive of something which is limited by the

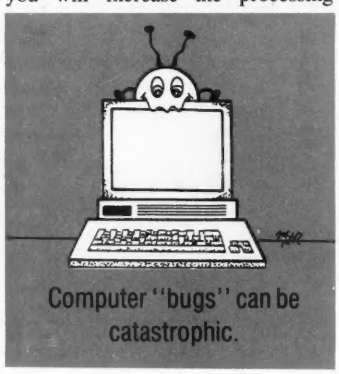




speed of light; it is a genuine problem. In a cockpit where a computer is simultaneously handling the automatic flight controls, navigation systems, communication systems, weapons delivery equipment, and a host of radar sensors, it doesn't take long before the computer instructions needed to do all of those jobs just do not come out fast enough.

To get around that problem, computer hardware engineers have designed computers which have a number of processors connected in parallel. In other words, a number of computers are hooked up together to increase the speed at which the data is processed. That works fine in principle and is relatively easy to do in terms of hardware design. What is not so easy is to write the software which makes that happen. That problem has been recognized by electronics engineers for some time. It was noted in a recent issue of *Aviation Week and Space Technology* that, "...higher speed processors offer the potential for meeting future avionics system demands, the preparation of software to drive these processors poses a serious challenge...."

Software design and engineering already is a difficult science when creating it for a single processor. To hook two or three computers in parallel does not necessarily mean that you will increase the processing speed by two or three times. The software to run several computer processors simultaneously is enormously complex. It not only has to process the information correctly, but also must decide which processor to send the data to and in what order. A lot of information can't simply be run through in parallel, but must be done in sequence. For instance, a navigation calculation cannot be made until aircraft speed, direction and other data have been determined. Certain calculations simply must be done sequentially.


Computer "bugs" can be catastrophic.

Computer Memory

To say that one software program is more complex than another is subjective. It is important to get an idea about how complex a computer program will be because the more complicated it is, the more subject to error it will be and the more it will cost to develop. A measurement used to determine complexity is computer memory. In simple terms, the more computer memory it takes to run a program, the more complex it is. That is not always a true statement but for general use it is true often enough.

To get an idea of how that affects Army Aviation you have to appreciate that the complexity of software in the cockpit has realized about a 10-fold increase every decade. I can remember working my first computer program in 1965 and being in awe of my fellow students who actually understood what they were doing. The programs running today are estimated to be about 100 times more complicated, which in some respects is a somewhat depressing thought.

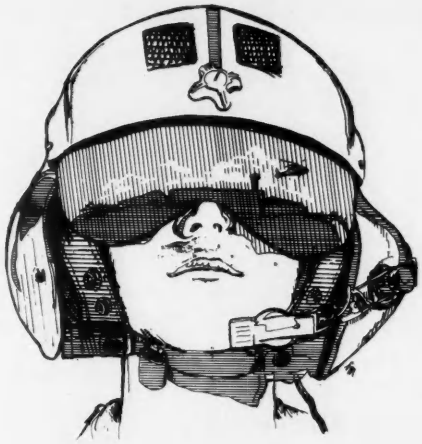
Software Cost

Software is expensive because it is what a manufacturer normally calls "labor intensive." It takes a lot of human ingenuity, skill and hard work to produce good, usable computer software. Contrary to the American myth, that every 13-year-old video game player is a computer whiz, a programer most frequently is a trained and highly educated engineer.

Not only does it take some highly skilled people to develop complex software, but also the rate that it is written is not fast. Experience says that you can expect to get about five lines of computer code per employee per day. That's not much. Programers do not whittle away at just five lines at a time. They write large programs and then work on getting the bugs out and improving the program. After all is said and done the average comes out to be five lines per day. You can easily see why programs that run over several hundred thousand lines of code are indeed quite expensive.

I don't envision a day when software questions will be a part of the annual writ, or even when it will be a part of some instructor pilot's store of checkride trivia. The fact remains, however, that software is very much a part of Army Aviation and is destined to increase in importance as the years go on.

USAARL Needs Aviators



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- Currently on flight status
- Current flight physical
- Up slip (medical qualification slip).

For more information, please contact USAARL at AV558-6864/5, FTS 533-6864/5 or commercial (205) 255-6864/5 and ask for the research aviator representative.

U.S. Army Information Systems Command

ATC ACTION LINE

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Jamaica, NY

See and Avoid

INVESTIGATION OF a recent "near miss" revealed that confusion may exist as to pilot responsibilities when receiving visual flight rules (VFR) radar assistance. To some extent this confusion also may exist for pilots conducting operations on instrument flight rules (IFR) flight plans but in visual meteorological conditions (VMC).

As difficult as it may be to swallow, in both situations it is the pilot's responsibility to avoid collision with other aircraft. You don't believe it? Let's look at what the Federal Aviation Regulations (FARs) and Airman's Information Manual (AIM) say.

FAR Part 91.67 (a) Right of Way Rules, General, tells us the following: "When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to 'see and avoid' other aircraft . . . ." In simple terms, regardless of the type of rules you are flying under, if you can see outside your aircraft *it is your responsibility to avoid other aircraft, "period."*

Part I of the Airman's Information Manual (paragraph 165d). "Terminal Radar Programs for VFR Aircraft" (Basic Radar Service, Stage II services) further explains that these services do not relieve pilots of their responsibilities to see and avoid other VFR aircraft. Also in the AIM (para 162) "Radar Traffic Information Service," pilots are reminded of their responsibilities to see and avoid other aircraft.

Why should it remain the pilot's responsibility to "see and avoid" in the radar environment? For starters, the pilots in command are responsible for the safe operation of their aircraft. That's a basic rule that you learn on "day one." Second, controllers may not "see" every aircraft, depending on whether they are using primary or secondary radar. Primary radar uses the signal returned or "bounced" directly from the target. Secondary radar uses returns transmitted from the aircraft transponder. Therefore, if a controller is operating in a secondary radar select mode, nontransponder equipped aircraft will not be shown. A third reason is controller workload. This may not sound like a good reason, but it is a "real" one. When a controller identifies traffic to a pilot and the pilot acknowledges that traffic, there may be a tendency for the controller to reduce his or her concentration on that target and focus on another.

The bottom line is: when receiving radar assistance in VMC conditions (while operating IFR or VFR) we must never relax and expect "others" to keep us clear. When targets are pointed out and we acknowledge them, we must not hesitate to speak up if we subsequently lose that traffic.

It is natural, and perhaps inevitable, that hours and hours of uneventful operations under the air traffic control umbrella insidiously build a misunderstanding of who is separating what from what. As long as the National Airspace System has aircraft operating on IFR clearances, or VFR traffic receiving radar services, as well as uncontrolled VFR aircraft in controlled airspace. the potential for near-midair collision will exist. We can expect that potential to increase with air traffic density.

Use the Air Traffic Control System but at the same time know *your* responsibilities while operating in it.

Readers are encouraged to address matters concerning air traffic control to: Director, USAATCA Aeronautical Services Office, Cameron Station, Alexandria, VA 22304-5050.